Vol. XXX APRIL 1936 Number 4

EXCAVATING ENGINEER

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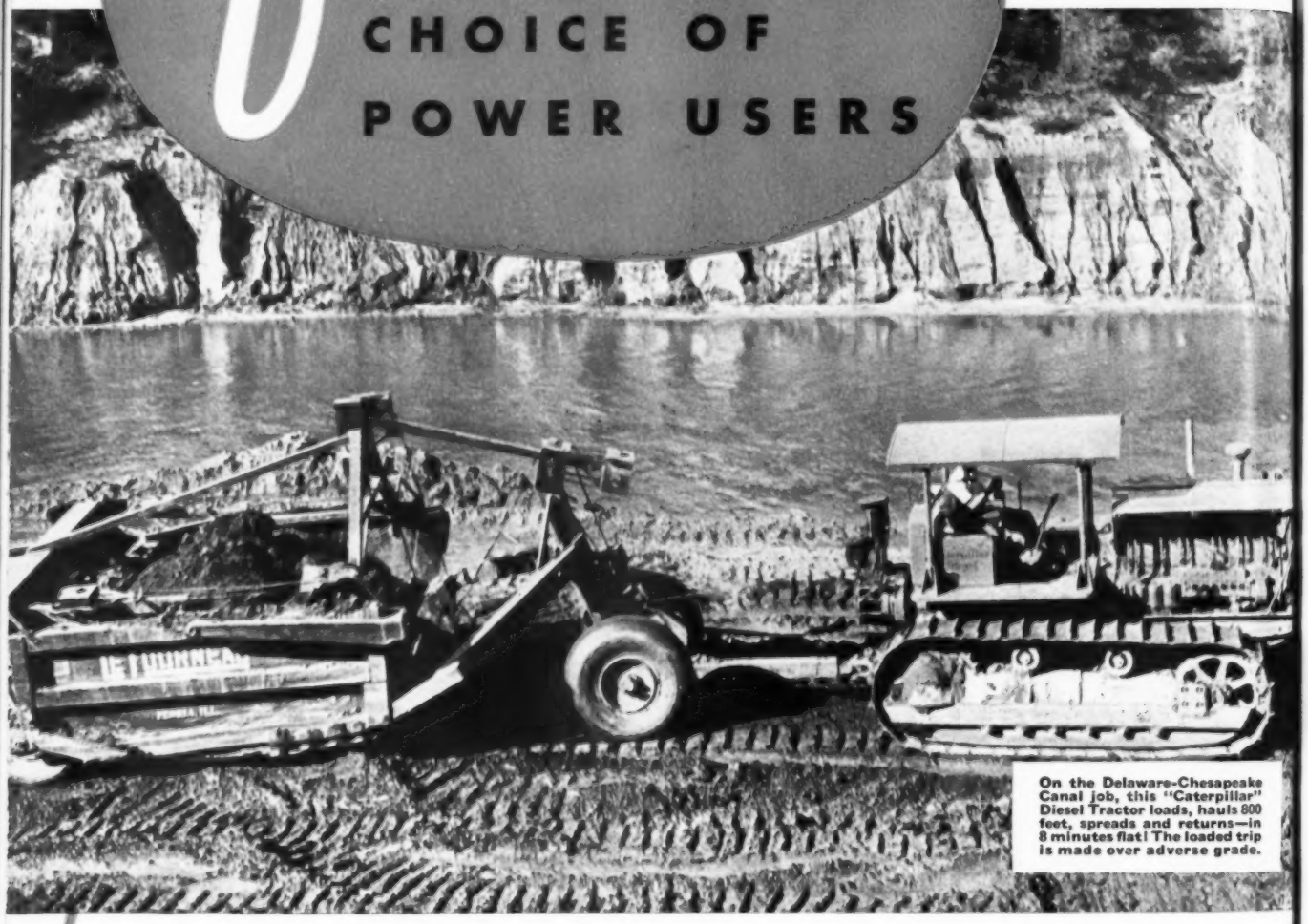
1836-1936
One Hundredth Anniversary of the Power Excavator.

ne hundred years ago, William S. tis, a 22-year-old contractor, con- ived an excavator powered by steam. ith the help of an even younger iend, he built the first steam shov- . Its success was the first step in e eventful history of modern exca- ting. Beginning on page 179 of this sue, the complete and authentic ory of the invention and early de- lopment of the power shovel is told r the first time.

Digging by "Stame"
by W. E. Farrell

first

CHOICE OF POWER USERS



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The "Caterpillar" Diesel Tractor is shattering cost records, boosting work-production figures. That's why it stands first today. It has set new standards for tractor power. It has brought a new basis for figuring bids and planning schedules. And it is first choice on the big jobs and the small—because it is first in performance, first in low operating costs, first in dependability and long life and low up-keep. Caterpillar Tractor Co., Peoria, Illinois, U. S. A.

HARD FACTS ON THE SHOW-DOWN

A contractor on the Atlantic Gulf Canal reports: "Our two 'Caterpillar' Diesel Tractors haul an average of 85 cu. yds. of earth per hour on a 500-foot haul—entirely through deep sand. The cost is approximately 7 cents per cu. yd.!"

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Send for a copy of the Cordeau book.

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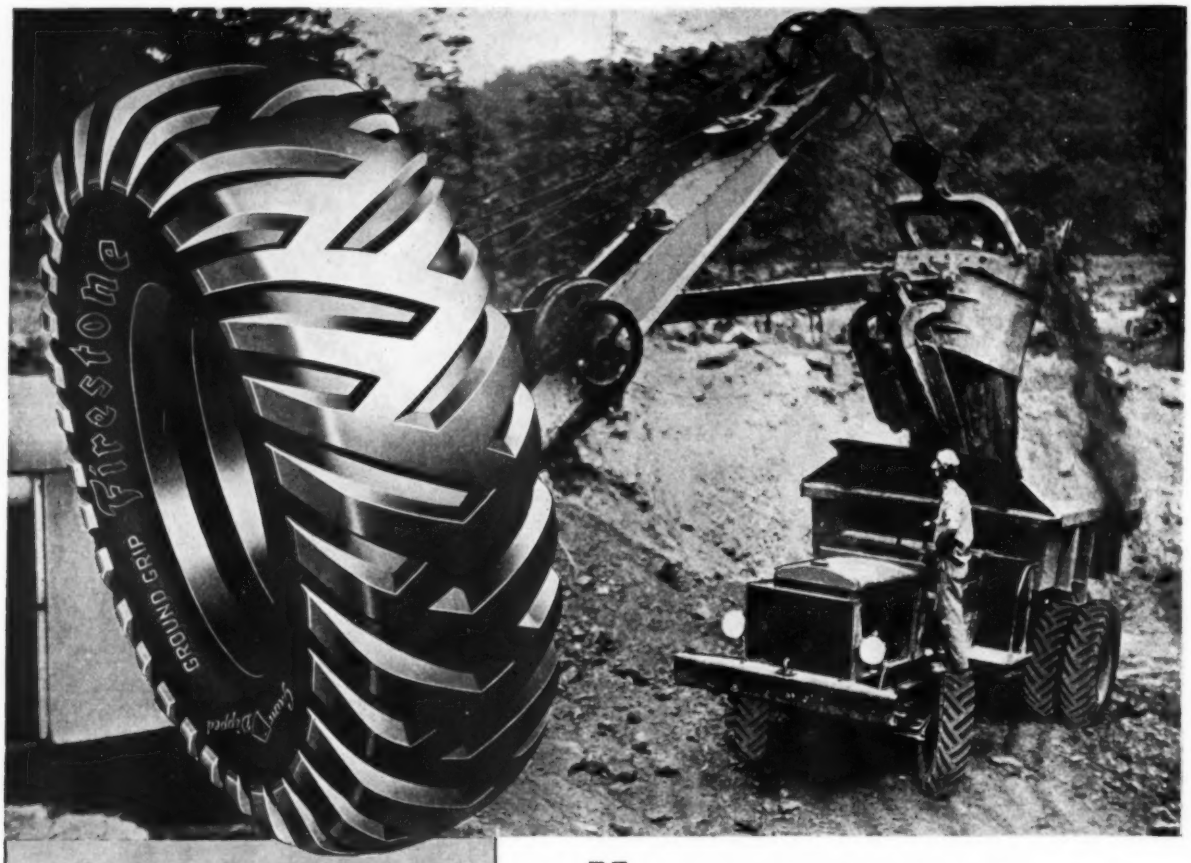

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FOUNDED IN 1905

EXCAVATING ENGINEER

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DEVOTED EXCLUSIVELY
TO EXCAVATION

About Excavating Projects — By Excavating Men — For Excavating Men — The World Over

Vol. 30 APRIL, 1936 No. 4

Contents

Beginnings of Modern Excavation ..... **Front Cover**

Wm. S. Otis built the first steam shovel 100 years ago. The original patent application, dated 1836, was destroyed by fire, but the second still exists. Its first page is reproduced on the cover, together with the earliest drawing of a shovel, made by S. Rufus Mason in Philadelphia in 1841.

Not in the Contract **174**

Digging by "Stame" by W. E. Farrell **179**

For many years Mr. Farrell has been collecting data for this history, which tells for the first time the accurate story of the earliest days of the power excavator.

"Patent 1089" **182–184**

Granted in 1839, Wm. S. Otis' second patent application is reproduced in full.

Central Valley Project Moves Ahead, by Khyber Forrester **187**

Field Notes **189**

Handy Match Scratcher 189
New Splint for Broken Legs 189
Latch Lift for Home made Machine 189

Editorial **190**

The Business Situation 190
Construction 90% Ahead of '35 190
Unemployment 191
Obituaries 191
Quality and Value 191

Equipment You Ought to Know About **192**

Two New Heavy Duty Trailers 192
Two and Four-cylinder Engines 192
Caterpillar Tractor Grader 192
New Light Hoist 206
New Oilproof Belting 206

Shots from the Firing Line **196**

Work to Start on Provo River Project 196
Excavation Completed on Three Tunnel Units at Aqueduct 196
Work Picks up at Fort Peck 196
All-American Canal Reaches Half-way Mark 198
Continue Federal Aid for Highways 198
Bartlett Dam 200
Yakima Ridge Canal 200
Ask Congress to Abolish Federal Gas Tax 202
Revised Bidding Regulations in New Jersey 202
Central Valley Appointments 204

Trade Notes **215**

Book Reviews **215**

Looking Ahead

These interesting articles will appear in early issues of Excavating Engineer. Watch for them!

Building Fort Peck Dam

Dredging operations for the earth fill core, diversion tunnel construction, and the excavation for the spillway will be presented in a series of articles starting in an early issue.

The Aqueduct Moves Along

J. F. Shea Co. complete Schedule 20 and prepare to begin 27,564 foot cut and cover work on schedule 18.

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F. O. WYSE
Managing Editor

ARNOLD ANDREWS
Editor

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D. B. REED, JR.
Assistant Editor

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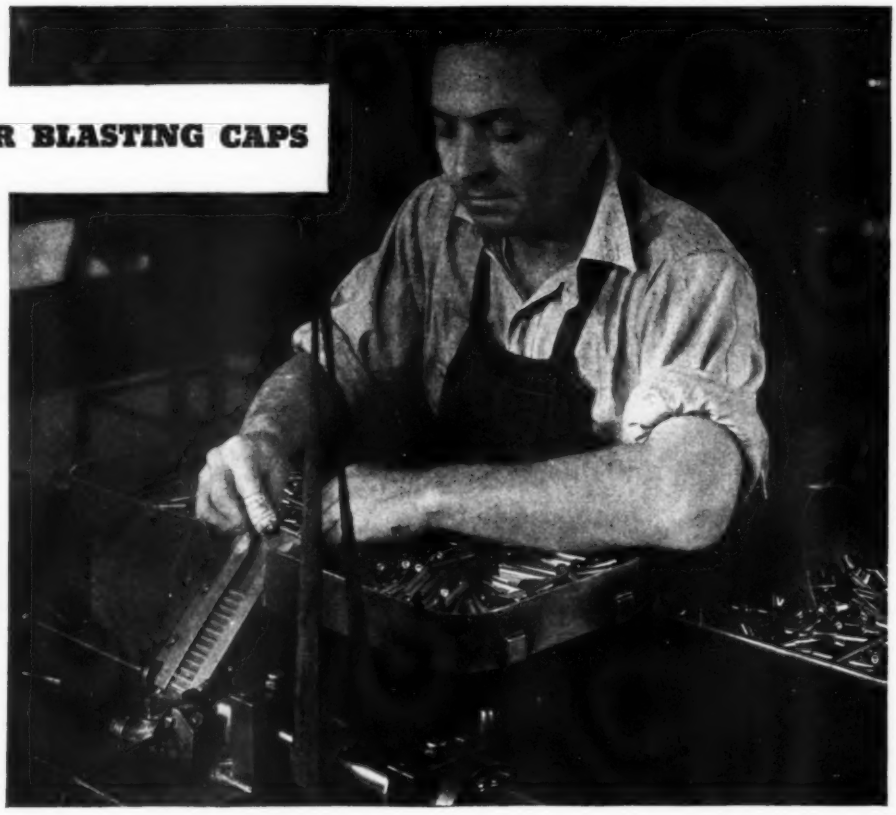
MAKING BETTER BLASTING CAPS



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REG. TRADE MARK

Not in the Contract

He was a stout man, with large, broad feet, and although several pairs of boots were shown to him he refused them.

"I must have square toes," he explained to the salesman.

The young man sighed. "But square toes are not stocked, now, sir," he insisted. "Pointed toes are fashionable this season."

The stout man gave an angry grunt. "That may be," he retorted, "but I happen to be wearing last season's feet."

Diner: "Have you any wild duck?"

Waiter: "No sir; but we can take a tame one and irritate it for you."

Small Boy: Dad, what are the holes in the board for?

Dad: Those are knotholes.

Small Boy (after due consideration): Well, if they're not holes, what are they?

Policeman: "Hey, you, where yuh going with nine buckets of water?"

Boy: "I'm going to drown a cat."

Father: "When I was a young man girls knew how to blush."

Daughter: "What was it you used to say to them?"

Jane: "My Scotch boy friend sent me his picture yesterday."

Joan: "How does he look?"

Jane: "I don't know yet. I haven't had it developed."

"Do you believe that tight clothing stops circulation?"

"Certainly not. The tighter a woman's clothing the more she's in circulation."

Mrs. Smith rushed into her living room. "Oh, John!" she cried, as she panted for breath, "I dropped my diamond ring off my finger and I can't find it anywhere."

"It's all right, dear," said John, "I came across it in my trouser pocket."

Contractor: "How is the patient in 742?"

Dr. Robinson: "He's anxious to get home to his wife."

Contractor: "Hm-m-m-! Still delirious, eh?"

A car is most enjoyable when it attains an age when you don't care whether it's washed or not.

Then there was the mechanical engineer who wanted to take his nose apart to see what made it run.

—STANLEY DONALDSON

Professor Wurst Solves Unemployment Problem—Almost

A customer stepped into a gun store, apparently intent on making a purchase. The salesman set about showing him what was in stock. The first weapon brought out was a handsome, single trigger, over and under Francot, and just about the last word in a very swell shotgun. The customer was very much interested, but the price, $600, was far beyond his means. The next assortment shown was a group of English doubles brought out by gunsmiths known all over the world for their expert craftsmanship. Still too high, thought the customer, and then asked if they had something cheaper.

Yes, the salesman said, there were some inexpensive models that were made in this country and he could let him have one in the neighborhood of $40.

"I'll take one of these," the customer told the salesman, with considerable enthusiasm. "It's really going to be a very simple wedding."

He: That's funny; my razor doesn't cut at all.

She: Don't be silly, Bill. Your beard can't be tougher than the linoleum.

"Why are you eating with your knife?"

"My fork leaks."

Mary: "John, dear, I'm to be in amateur theatricals. What will people say when they see me in tights?"

John Jones: "They'll say I married you for your money."

If you think your arguments are so convincing, try persuading the small boy that he ought not to have a pet dog.

Little Jane, age 5, contentedly licking a lollypop, came into Jones' drug store and said her mama wanted a roll of tissue paper. Jones wrapped it up and handed it to her.

"Charge it, pleath," said Jane.

"Certainly," replied Jones. "But who it is for?"

"All of uth," lisped the little tot, as she sauntered blithely on her way.

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Many years of experience, building pneumatic tire hauling equipment, established the Koehring Dumptor as an exceptionally speedy dirt-moving unit. Low maintenance, extra yardage moved, a minimum of delays, are assured in "tough-going."

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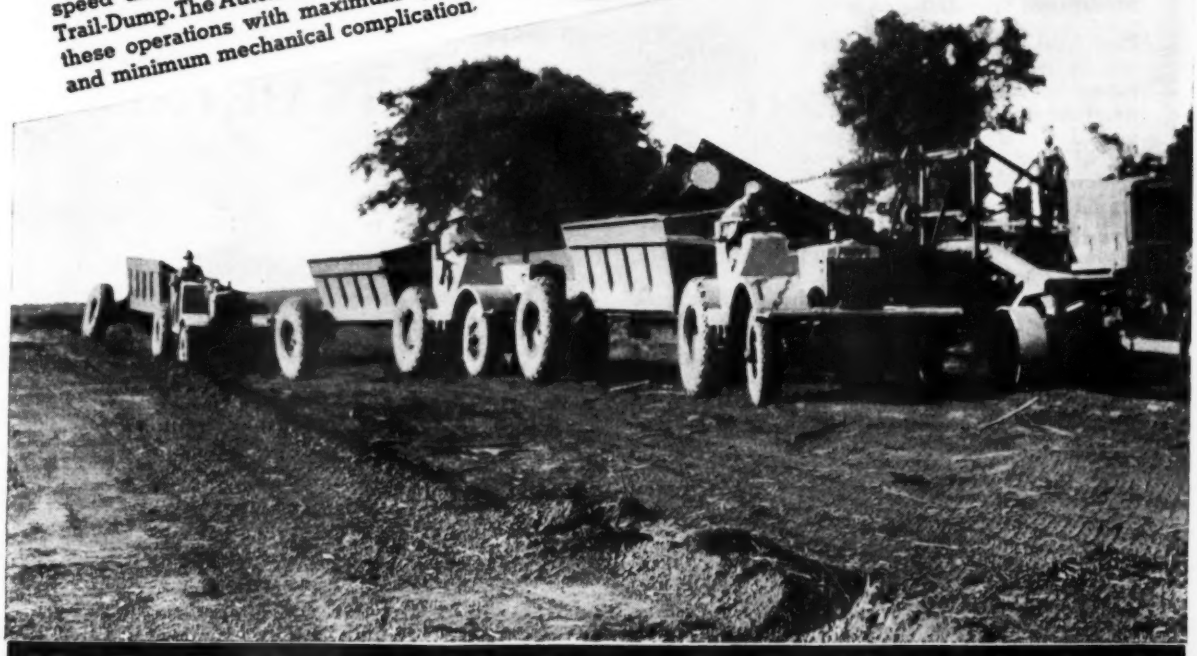

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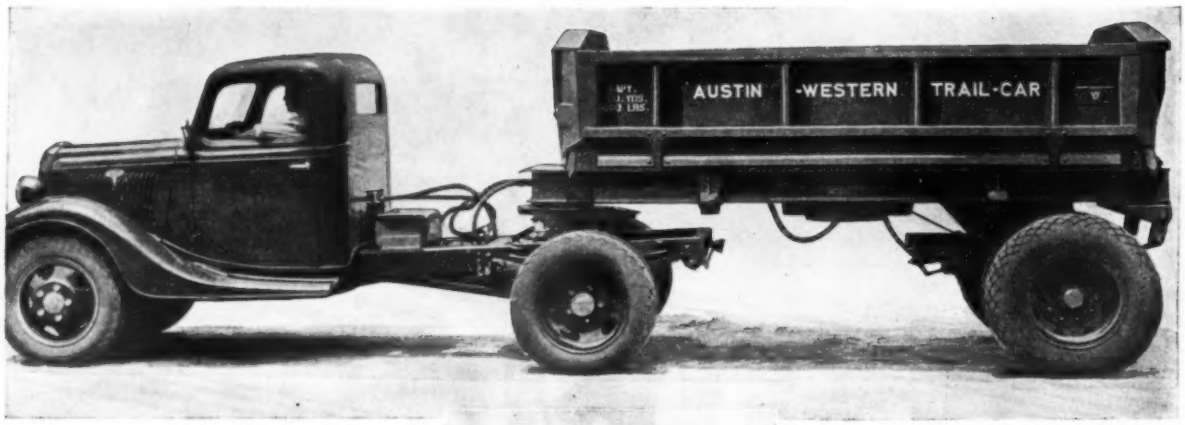

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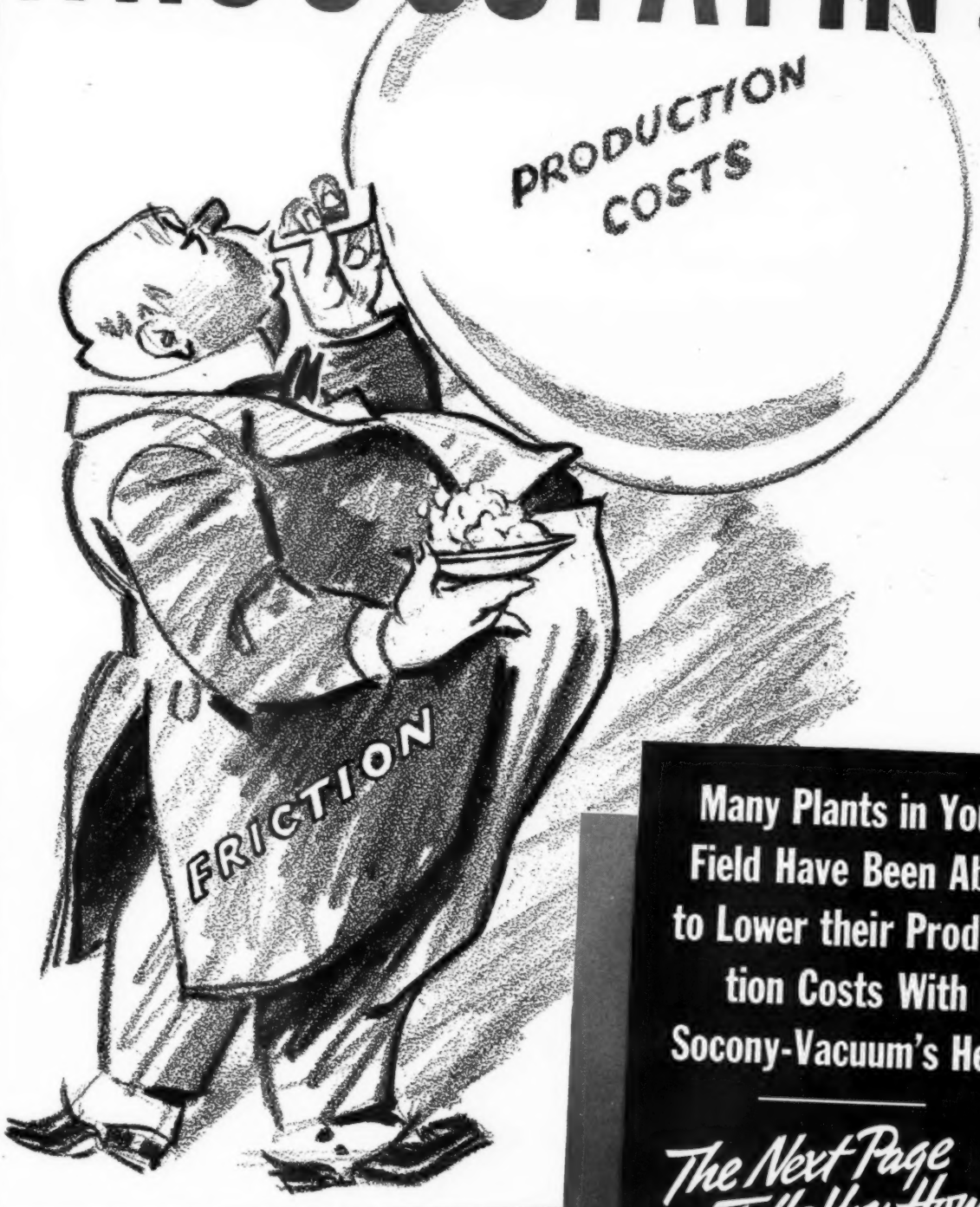
WHO'S GOT A PIN?



Many Plants in Your Field Have Been Able to Lower their Production Costs With Socony-Vacuum's Help

The Next Page Tells You How—

back. There is a leak in the fuel line and it might get worse. When we took off, a fuel flow gauge broke its glass and I find that it is

Visibility has been

cellent for the past

and the observations

sires may be made

flight. Interference

has made

from the

of genuine liquors greatly. A large

on every bottle of imported

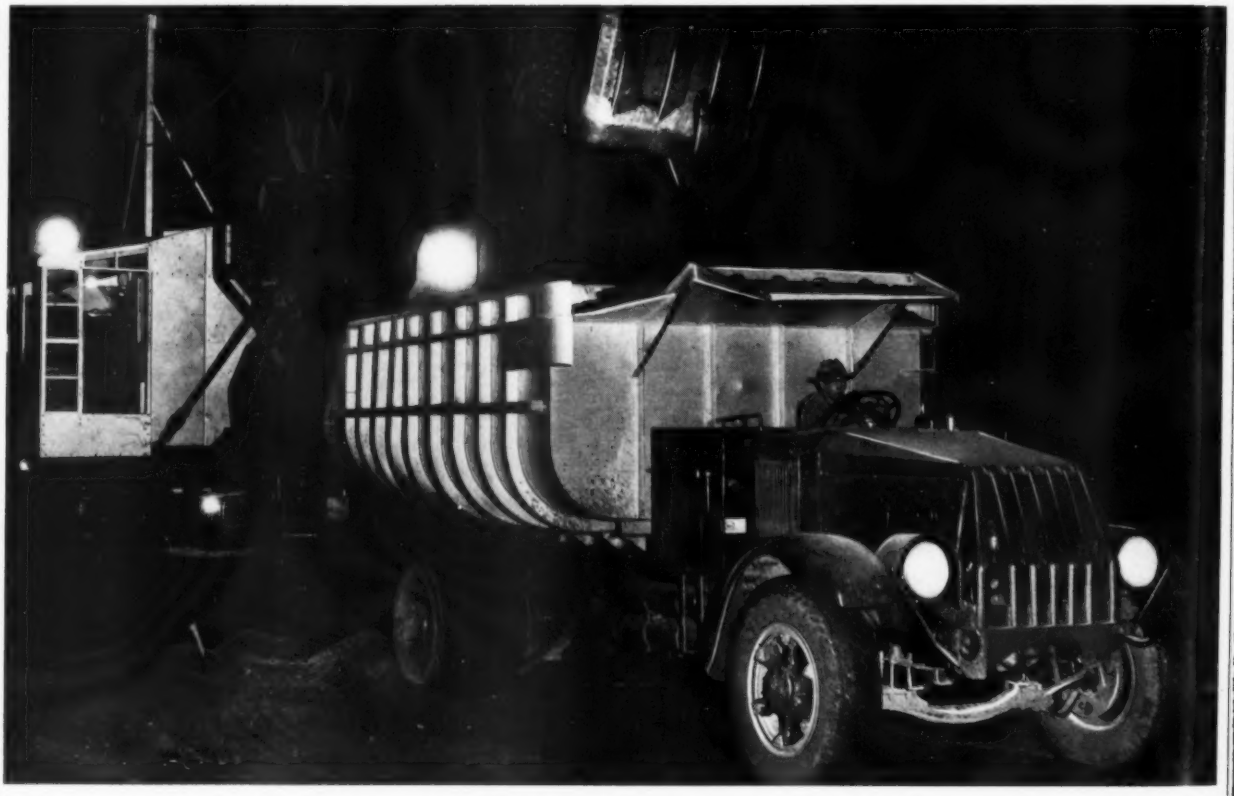
years. Stud... are beginning to realize that temperature, humidity, pressure and cleanliness do not tell the whole

to short-term paper. The government, municipalities and corporations of strong position have it all their own way, to borrow money cheaply for long terms.

...ment securities. ...ities point out. There is no inclination to return to an attitude that prevailed earlier in the depression, which was to sit on cash assets and ignore the

modern world will facilitate the return of prosperity the same as it hastened the development of the crisis," he concluded.

TIME SAVED BEFORE THE JOB BEGINS!



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The calls involved in refundings have withdrawn bonds from many private sources and, in cases where direct exi... have not been afford... holdings ...

Trend Toward Concentration.

An accumulating result of this phase of refunding operations has been that ... of ma...

...tions to put part of their idle funds to work, but it has done little to reduce the aggregate of idle capital.

There has been an even more di... in that direction in the...

Cites Recovery Signs

He pointed to improvement in agriculture, industrial production, and the inde... French prices a...

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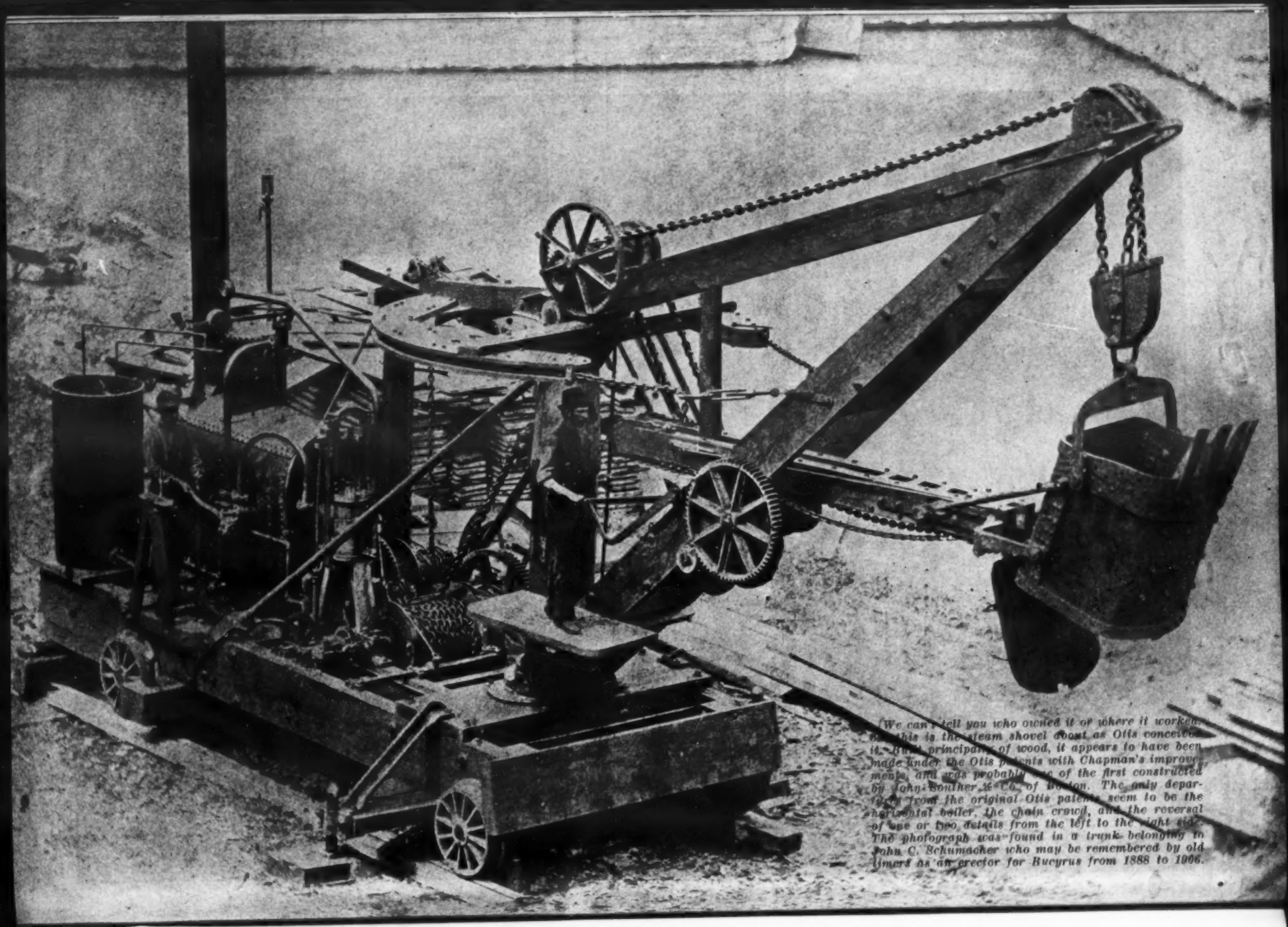

We can't tell you who owned it or where it worked, but this is the steam shovel about as Otis conceived it. Built principally of wood, it appears to have been made under the Otis patents with Chapman's improvements, and was probably one of the first constructed by John Souther & Co., of Boston. The only departure from the original Otis patents seem to be the horizontal boiler, the chain crowd, and the reversal of one or two details from the left to the right side. The photograph was found in a trunk belonging to John C. Schumacher who may be remembered by old timers as an erector for Bucyrus from 1888 to 1906.

Digging by "Stame"

The first complete and authentic history of the steam shovel, from its invention in 1836 to 1880

By WILLIAM ELLISTON FARRELL

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THIS ACCOUNT is an effort to tell the story of the early steam shovels and to arouse interest in and due recognition for the inventor, whose originality has contributed so much to the world's economic progress. There are no large and but few small works of construction or destruction on which one or more shovels are not employed.

In 1893, Mr. E. A. Hermann made the first comprehensive review of steam shovels in an address before the A.S.C.E., which was later published in book form. His report dealt only with the art and manufacture of the previous ten or fifteen years. It is much to be regretted that with this inspiration a complete early history was not then attempted, as many of those associated with the first shovels were still alive.

In 1924 an article appeared in one of our trade journals upon the origin and development of contractors' equipment. Here for the first time an effort was made to describe completely the origin and early use of the steam shovel. The facts given there have served as the basis for all subsequent writings on the subject, without apparent effort to confirm the statements made. The author of that article says that he has unfortunately "long since destroyed his notes and the information from which he made up the article".

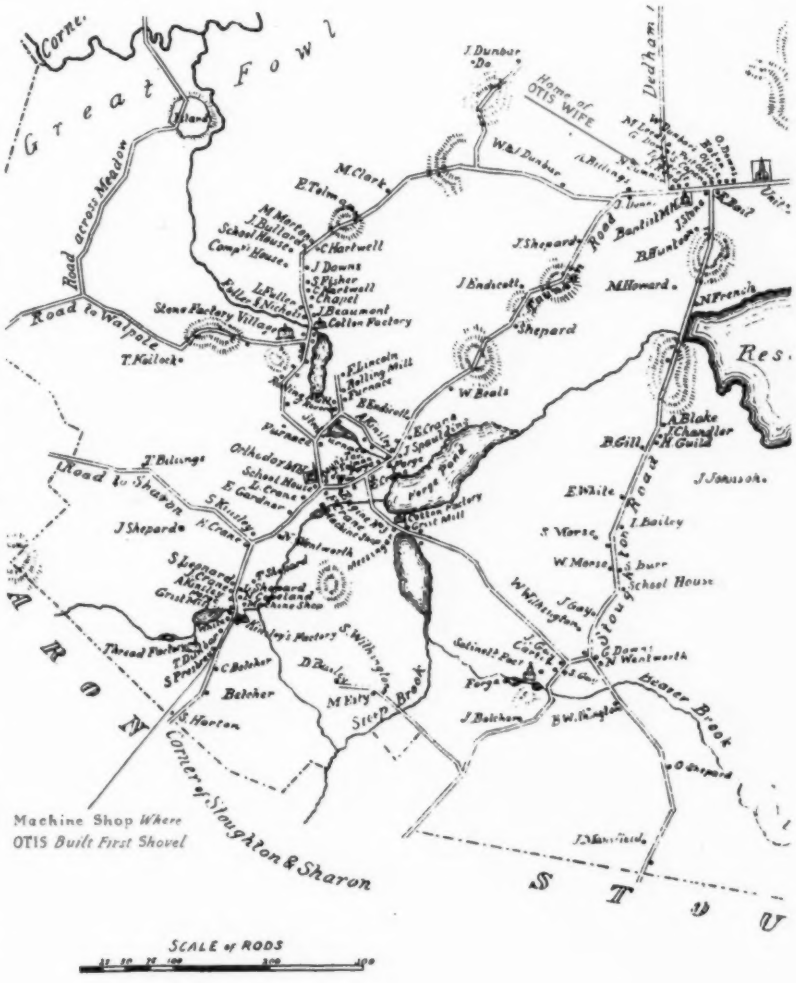
Two Patent Applications

That William Smith Otis is the inventor, there is no doubt, although his name is today comparatively unknown. His original application for a patent was filed June 15, 1836, but all the accompanying correspondence, drawings and model were destroyed by fire in the patent office and another application for patent became necessary. The second application was filed October 27, 1838, the patent being allowed February 24, 1839, patent No. 1089. Unfortunately, no drawing accompanying this second application is now available.

The original shovel was a success and the modern shovel differs but little from it in basic principle of operation. The motive power has been changed, due to the advent of gasoline and electricity.

With Otis' death at the early age of 26, the development of the shovel, its use in the field of construction, and, we might say, human progress due thereto lay dormant for about 25 years.

The great difference between Otis' idea of a mechanical excavator and all previous conceptions was clearly set forth by a



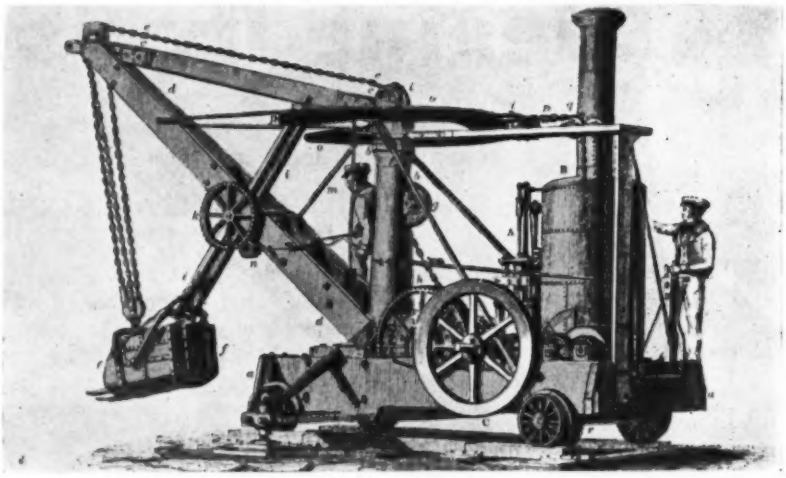
● This 1831 map of Canton, Mass., shows the machine shop where Wm. S. Otis built his first shovel. Also indicated is the home of L. Everett, father of Mrs. Otis.

writer who, in 1843, stated its points of superiority to be:

First. It is a locomotive, self-propelling.
Second. Earth is broken up and carried away by a single instrument, a scoop.
Third. The machine cuts with equal facility at any inclination to the horizon.
Fourth. By means of this machine a channel can be cut through a hill with proper sloping sides and a level base correctly formed.
Fifth. The capability of the machine for cutting several feet below the base on which it runs.

These features still distinguish this excavator from all other forms and man's ingenuity in the last hundred years has been unable to conceive of a superior machine for the same purpose.

There was no satisfactory power excavator before Otis' invention. Practically all excavation was by pick, shovel and wheelbarrow. The cost or even the possibility of constructing our highways, railroads, canals, dams, tunnels, excavations for our skyscrapers or loading operations in our mines and quarries, metallic and non-metallic, without the shovel is inconceivable.



● *Drawing published in the London Journal in 1843. Except for the addition of the craneman and operator, this is a duplicate of the Mason drawing.*

With Pick and Shovel

To give some idea of the organizations required in Otis' day on excavations take these quotations:

"For the removal of 28,414 cubic yards of earth there were required 4597 men and 495 horses."

"The progress on this railway was so rapid in 1839 that not less than 450,000 cubic yards were effected per month and the number of men employed amounted to 8600."

For at least twenty years only two shovels were in use in the United States, and none were made abroad until England did so in 1876.

These circumstances may be partly accounted for by the death of the inventor in 1839; because the manufacturers of the shovels went to Russia in 1844, taking with them a large portion of their plant equipment; and lastly by the desire of the contractors owning the two shovels to possess this advantage over their competitors.

"Steam" vs. "Power" Shovels

While it is technically correct to call the original Otis invention a "steam shovel;" and such it remained until about 1900, when other forms of power were applied to it; it is more correct today to designate it as a "power shovel." Unfortunately, the foreign technical press and manu-

The Author

WILLIAM ELLISTON FARRELL was born in Nashville, Tennessee, and was graduated as a mining engineer from Vanderbilt University in 1891.

After a European trip with his university professor of metallurgy, Mr. Farrell took a few dollars and some highly complimentary letters to Pittsburgh. When prominent men there declined to be suitably impressed, he returned to teach chemistry at Vanderbilt.

Later, a position as chemist (salary $50 a month) with a blast furnace brought about his return to Pennsylvania, which state has been the center of his business activity ever since. In 1914, Mr. Farrell went into business for himself, as owner and president of the Easton Car and Construction Company, Easton, Pennsylvania, which manufactures industrial car and other material handling equipment.

About 1920, the transportation problem in quarries became an obsession with him, and he began an exhaustive study of the subject. In those days taking "movies" was principally a social stunt, but Mr. Farrell bought one of the best machines he could obtain, and the more he used it, the more he saw how much had to be learned to tell correctly the story of what lay between the quarry face and the crusher. Concrete results of this study came in the form of many improvements in transportation equipment, some of them covered by patents.

A more indirect result of the "movies" taken (a series of them showing handling of stone by steam shovels) was an interest in shovels—which led him to make this study of the origin and early development of the steam excavator.

Several years ago, Mr. Farrell turned over to others the details of his business not pertaining to quarries, and made his headquarters at his New York office where he could best advise with crushed stone producers and pursue his expert study of quarry transportation problems.

Mr. Farrell was one of the group which organized the Manufacturers Division of the Crushed Stone Association, and is a member of the Institute of Quarrying, of England, before which he has delivered several addresses.

facturers do not differentiate carefully between the different forms and kinds of power excavators when speaking of the power shovel. A power shovel in the United States is not a skimmer, back digger, trench hoe, crane, clamshell, back filler, dragline, drag shovel or dredge, etc., and yet in the foreign technical press and catalogs, "steam navvy", "pelle a vápeur", "pala a vapor" or "loffel-bagger", may be used to designate one or more of the various modifications. Within this article a steam shovel is an excavator intended for operation on land, is driven by steam and has a boom with a dipper rigidly attached to a dipper stick which is not hinged.

In 1835, Otis was engaged on a construction contract which his firm, Carmichael, Fairbanks and Otis, had with the Boston and Providence Railroad. He made his temporary home at Canton, Massachusetts, and it was there that, with the assistance of a friend, Charles Howe French, who had just completed his apprenticeship, the first "Crane Excavator", as he called the machine in his application, was built. The phrase "Crane Excavator" used in the patent application conforms well to descriptions of this first shovel, where it is referred to as consisting of two parts, a power plant and a quarry derrick (or crane).

Early Description of First Shovel

The following description is believed to be of this original shovel built by Otis and French.

"It was built along the lines of a quarry derrick, having a mast supported by cables attached to the top and anchored to dead men placed on the ground. The mast was provided with a boom, to which was hinged the end of the dipper handle, making it necessary to raise and lower the boom for each dipper load, similar to the Oswego boom machine. This application was effected by a double drum hoisting engine.

"No mechanical provision was supplied to swing the boom. Therefore, a rope was attached on each side of the boom at the point, and the boom was swung by two men on the ground, one on each side; one of these men tripped the bucket also. The machine was moved ahead in the same manner as a quarry derrick is moved, and in some cases it required half a day to make one move-up. This experimental machine did not prove to be altogether satisfactory; therefore the derrick, boom, dipper, etc., were moved back on to the frame."

The spot where the original crane was built is described as "near the Upper Silk Factory where the Massapoag Brook crosses Shepard Street." The lo-

William S. Otis

IN 1631 JOHN OTIS emigrated from England and settled at Hingham, Massachusetts. Seven generations later two of his descendants, distantly related, but of the same surname, invented appliances which will ever be of great service to man. While the name of one will always be associated with elevators, the fame of the other seems to have departed for all practical purposes shortly after his death.

William S. Otis, the inventor of the steam shovel (more properly called today the "power" shovel) was born on September 20, 1813 at Pelham, Massachusetts. His father was postmaster there, later becoming a contractor in Pennsylvania, and still later president of a New York City bank.

The Otis family moved to Philadelphia when he was about 15 or 16 years old. Of his education and business training, there are no records, though he probably acquired a knowledge and interest in contracting through association with his father. When he was about 20, young Otis joined the contracting firm of Carmichael and Fairbanks, of which the senior partner, Carmichael, was his brother-in-law.

By 1834 he had either bought an interest in the firm, or his talent had merited the same reward, for as Carmichael, Fairbanks and Otis, the firm contracted for the construction of a part of the Boston and Providence Railroad, now known as the New York, New Haven and Hartford.

Otis then lived in Canton, Massachusetts and it was while here, in the year 1835, that his conception of the shovel grew to perfection. With the assistance of his even younger friend, French, a steam shovel was built and actually put in operation by the latter.

But everything was not business for Otis in Canton. On Sunday afternoons he and his young friends often gathered at the home of Deacon Leonard Everett, who had several charming daughters. On June 25, 1835, Otis married one of these daughters, Elizabeth. Later, French married another, and John D. Dunbar, a third. These men, and O. S. Chapman, who later married Elizabeth Everett Otis, all became well known as reputable and successful contractors.

When the contract with the Boston and Providence was completed in the fall of 1835, Otis returned with his bride to Philadelphia, possessed with the idea of building another and better steam shovel. There he had a cousin, Rufus S. Mason who was an instructor in drafting, to assist him with his drawings. Although he set to work at first to build the shovel himself, from parts constructed at various machine shops, he soon turned the entire job over to the firm of Garret and Eastwick—later Eastwick and Harrison—and they produced the machine faithfully portrayed in a much photographed drawing which Mason made in 1841.

Soon after the completion of this first Philadelphia shovel, in 1837, Otis used it on the construction of the Western Railroad of Massachusetts (now the Boston and Albany) and it was while so engaged that he died of typhus fever at Westfield, Massachusetts, November 13, 1839 at the early age of 26. While on this Western Railroad job, Otis made and used what was probably the first industrial locomotive—a four ton machine with an upright boiler and an engine with oscillating cylinders.

Two children of Otis died in infancy. His widow married his friend and cousin, O. S. Chapman in 1845.

[33]
LOCOMOTIVE
ENGINES.
EASTWICK & HARRISON,
LOCOMOTIVE AND STATIONARY ENGINE MAKERS,
AND GENERAL MACHINISTS,
North-west corner of James and Twelfth Street,
ON THE WILLOW STREET RAIL ROAD,
PHILADELPHIA.
Are prepared to receive orders for Machinery in their line, which they will engage to execute with promptness, and in a workmanlike manner.
They would particularly call the attention of Rail Road Companies to the improvements they have made in Locomotives, by which either Anthracite Coal or Wood can be used, with perfect facility, in boilers of the ordinary horizontal form. Also, to their eight-wheel Engines, which are admirably adapted to roads having high grades to overcome, and are capable of drawing heavier loads, with less injury to the road, than any other description of Engine of the same weight used in this country.
Satisfactory references can be given as to the power and workmanship of their Engines, by those who have used them.
A. M. EASTWICK. JOSEPH HARRISON, Jr.

● *The Philadelphia firm of Eastwick & Harrison helped Otis considerably in the building of his first shovel in that city. They were also locomotive and engine makers, as shown by this ad which appeared in 1840.*

NO DRAWING AVAILABLE

UNITED STATES PATENT OFFICE.

WILLIAM S. OTIS, OF PHILADELPHIA, PENNSYLVANIA.

CRANE-EXCAVATOR FOR EXCAVATING AND REMOVING EARTH.

Specification of Letters Patent No. 1,089, dated February 24, 1839.

To all whom it may concern:

Be it known that I, WILLIAM SMITH OTIS, civil engineer, of the city of Philadelphia, in the State of Pennsylvania, have invented certain improvements in the apparatus for and mode of excavating earth for the construction of railroads, canals, or other purposes where excavation may be necessary, which I effect by means of certain appendages to a scraper of the ordinary construction, which scraper is to be worked by a crane and is to take the earth immediately from the banks from which the excavations are to be made; and I do hereby declare that the following is a full and exact description thereof.

The drawing which accompanies this specification represents the crane, which I employ in excavating and with which I am at present operating, but I do not mean to confine myself to the exact construction and arrangement of this part, as it may be varied in its details, while the same effects may be produced by it. This crane is shown in Figure 1 as stationed upon a movable carriage, or car, and is situated on a temporary railway, and is intended to be so constructed that the load of earth taken off by the scraper may be raised by it, while the turning of the crane also to the point where the load is to be dumped, whether into cars or boxes on the road, or elsewhere, is controlled and regulated with great precision.

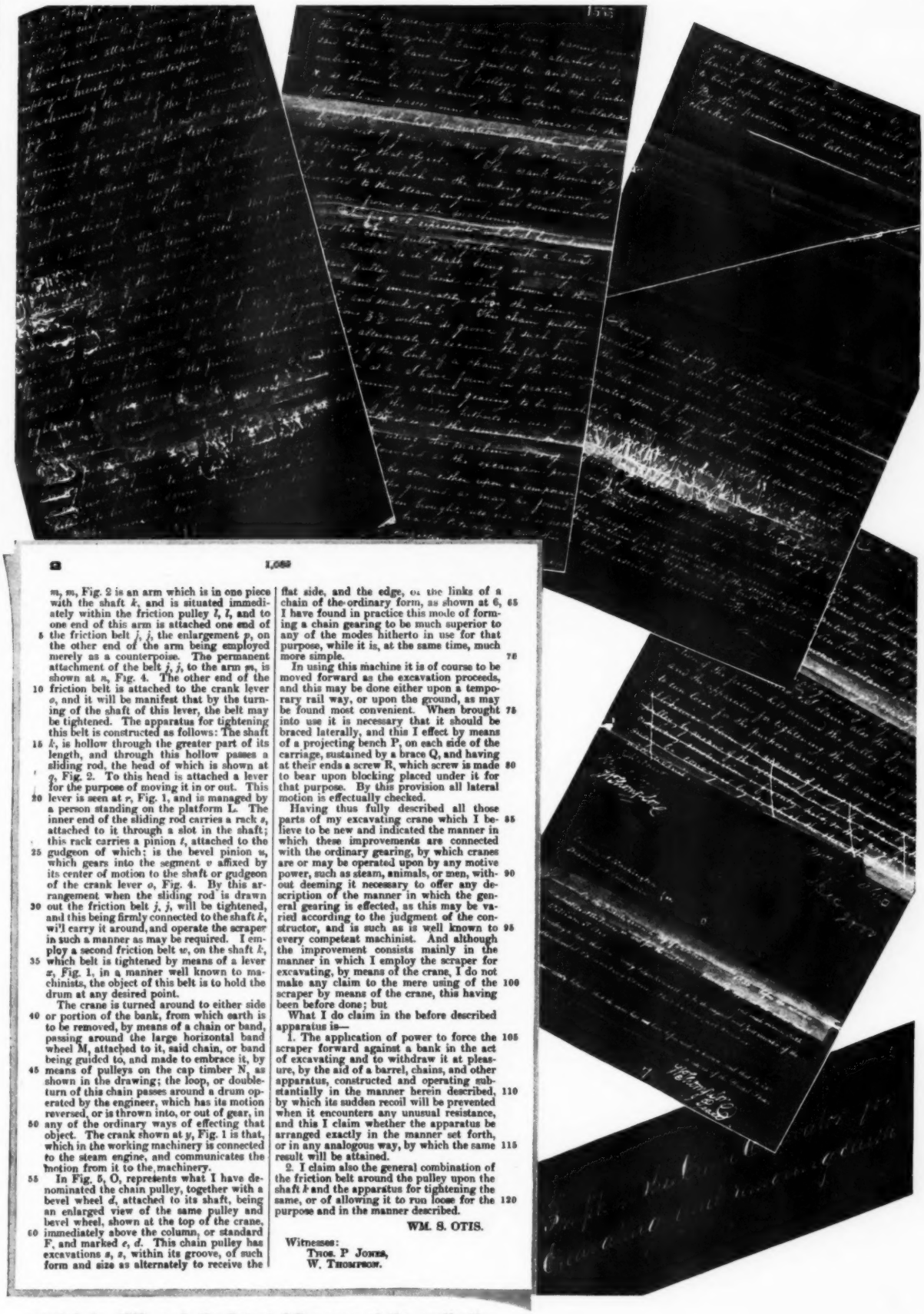
In the accompanying drawing, A, represents the scraper suspended from the crane, by means of the ordinary tackle; this tackle serving to raise it in the act of excavating, and to lower it when required. The end B, of this scraper is hinged to it, and has a bolt which keeps it in place when desired, or allows it to be opened and discharge its contents from that end. Such arrangements are well known to engineers and do not, therefore, require to be particularly described by me.

C, C, are two arms which are attached firmly to the scraper by means of the braces *a*, *a*, or in any other convenient mode. To these arms I connect an apparatus by means of which the scraper may be made to advance, or by which it may be drawn back at pleasure; which apparatus is worked, and a power governed in the following manner:

D is the boiler of a steam engine, which engine is not shown in the drawing, as it does not differ from others in common use. The engine gives motion to the drum E, around which is wound the chain *b*, *b*, *b*, which is connected with the scraper A, by means of tackle arranged in the ordinary way as shown in the drawing. The chain is conducted from the drum up through the column, or standard F, which supports the crane. In the side of this column there is an opening furnished with a pulley, under which the chain is conducted; and after entering this opening it passes up through the column, and through the upper arm of the crane G, where it passes over a second pulley *c*, of a particular construction, to be presently described, and which I denominate a chain pulley. This latter pulley is fixed firmly upon its shaft or gudgeon, and upon one end of this shaft or gudgeon is the bevel wheel *d*, which gears into the wheel *e*, carrying the shaft *f*, which shaft has on its lower end another bevel wheel *g*. This latter wheel gives motion to a shaft *k*, between the main braces, or lower arms of the crane H, H. This shaft, and its appendages are for carrying the scraper out and in as may be required, the bevel wheel *g*, taking into a bevel wheel on the end of this shaft; the motion of the shaft *k*, is governed by a peculiarly constructed apparatus of my invention.

Fig. 2 is an enlarged view of this apparatus and of the shaft *k*, which croses between the main braces H, H, Fig. 1; *h* being a bevel wheel at one end of it, into which the bevel wheel *g*, Fig. 1 is geared, *i*, *i*, are the gudgeons which run in bearings in the arms H, H, I, is a pinion, which in my working machine, is nine inches in diameter, and gears into the spur wheel J, Figs. 1 and 3, three feet in diameter. Upon the shaft of this latter wheel is the drum K, Fig. 3, which is also situated between the main braces H, H, carrying chains in reversed directions which chains are attached respectively, to the opposite ends of the arms C, C, of the scraper; these arms rest upon the drum K, their under sides being ironed to prevent their wearing. Upon one end of the shaft *k*, Fig. 2, there is a friction belt *j*, *j*, which passes around a pulley *l*, *l*, shown also in the end view Fig. 4. The pulley *l*, *l*, and the bevel wheel which is firmly attached to it, run loosely on the end of the shaft *k*, and revolves, therefore without turning the shaft, unless the friction belt, (one end of which is firmly attached to the shaft), is tightened,

Reproduced here are photostats of Otis' restored patent application.



2 1,063

m, *m*, Fig. 2 is an arm which is in one piece with the shaft *k*, and is situated immediately within the friction pulley *l*, *l*, and to one end of this arm is attached one end of the friction belt *j*, *j*, the enlargement *p*, on the other end of the arm being employed merely as a counterpoise. The permanent attachment of the belt *j*, *j*, to the arm *m*, is shown at *n*, Fig. 4. The other end of the friction belt is attached to the crank lever *o*, and it will be manifest that by the turning of the shaft of this lever, the belt may be tightened. The apparatus for tightening this belt is constructed as follows: The shaft *k*, is hollow through the greater part of its length, and through this hollow passes a sliding rod, the head of which is shown at *q*, Fig. 2. To this head is attached a lever for the purpose of moving it in or out. This lever is seen at *r*, Fig. 1, and is managed by a person standing on the platform L. The inner end of the sliding rod carries a rack *s*, attached to it through a slot in the shaft; this rack carries a pinion *t*, attached to the gudgeon of which; is the bevel pinion *u*, which gears into the segment *v* affixed by its center of motion to the shaft or gudgeon of the crank lever *o*, Fig. 4. By this arrangement when the sliding rod is drawn out the friction belt *j*, *j*, will be tightened, and this being firmly connected to the shaft *k*, wi'l carry it around, and operate the scraper in such a manner as may be required. I employ a second friction belt *w*, on the shaft *k*, which belt is tightened by means of a lever *x*, Fig. 1, in a manner well known to machinists, the object of this belt is to hold the drum at any desired point.

The crane is turned around to either side or portion of the bank, from which earth is to be removed, by means of a chain or band, passing around the large horizontal band wheel M, attached to it, said chain, or band being guided to, and made to embrace it, by means of pulleys on the cap timber N, as shown in the drawing; the loop, or double-turn of this chain passes around a drum operated by the engineer, which has its motion reversed, or is thrown into, or out of gear, in any of the ordinary ways of effecting that object. The crank shown at *y*, Fig. 1 is that, which in the working machinery is connected to the steam engine, and communicates the motion from it to the machinery.

In Fig. 5, O, represents what I have denominated the chain pulley, together with a bevel wheel *d*, attached to its shaft, being an enlarged view of the same pulley and bevel wheel, shown at the top of the crane, immediately above the column, or standard F, and marked *e*, *d*. This chain pulley has excavations *z*, *z*, within its groove, of such form and size as alternately to receive the flat side, and the edge, of the links of a chain of the ordinary form, as shown at 6, I have found in practice this mode of forming a chain gearing to be much superior to any of the modes hitherto in use for that purpose, while it is, at the same time, much more simple.

In using this machine it is of course to be moved forward as the excavation proceeds, and this may be done either upon a temporary rail way, or upon the ground, as may be found most convenient. When brought into use it is necessary that it should be braced laterally, and this I effect by means of a projecting bench P, on each side of the carriage, sustained by a brace Q, and having at their ends a screw R, which screw is made to bear upon blocking placed under it for that purpose. By this provision all lateral motion is effectually checked.

Having thus fully described all those parts of my excavating crane which I believe to be new and indicated the manner in which these improvements are connected with the ordinary gearing, by which cranes are or may be operated upon by any motive power, such as steam, animals, or men, without deeming it necessary to offer any description of the manner in which the general gearing is effected, as this may be varied according to the judgment of the constructor, and is such as is well known to every competent machinist. And although the improvement consists mainly in the manner in which I employ the scraper for excavating, by means of the crane, I do not make any claim to the mere using of the scraper by means of the crane, this having been before done; but

What I do claim in the before described apparatus is—

1. The application of power to force the scraper forward against a bank in the act of excavating and to withdraw it at pleasure, by the aid of a barrel, chains, and other apparatus, constructed and operating substantially in the manner herein described, by which its sudden recoil will be prevented when it encounters any unusual resistance, and this I claim whether the apparatus be arranged exactly in the manner set forth, or in any analogous way, by which the same result will be attained.

2. I claim also the general combination of the friction belt around the pulley upon the shaft *k* and the apparatus for tightening the same, or of allowing it to run loose for the purpose and in the manner described.

WM. S. OTIS.

Witnesses:
THOS. P JONES,
W. THOMPSON.

granted in 1839, and the Patent Office copy of the application.

cation of this shop is indicated on the map of Canton, which was made in 1831. (See map on page 179.)

The first shovel was taken to Worcester, Massachusetts, according to the best information available, where it was operated by French in the construction of the Norwich and Worcester Railroad, and the feasibility of excavating by a power shovel fully demonstrated.

This shovel has generally been ignored, and the one built later in Philadelphia called the "first."

After leaving Canton, it was natural that Otis should return to his father's home in Philadelphia and that, having no more permanent home, owing to the nature of his business, he should speak of himself in his application as being a resident of Philadelphia. The Quaker City was also attractive to Otis because of its several well equipped machine shops and skilled mechanics, as he evidently contemplated the building of a shovel more nearly conforming to his conception.

The First Philadelphia Shovel

Otis returned to Philadelphia in 1836 and attempted through his own efforts and without any assistance, to have various parts of the improved shovel as he conceived it built under his direction in several shops. This attempt proved unsuccessful and he was possibly on the verge of failure, owing to the difficulties arising from this method, when he fortunately became acquainted with the firm of Garret and Eastwick, to whom he brought his several parts and to whom he gave an order to build a complete machine. This firm had a foreman, Joseph Harrison, Jr., of unusual skill and ability, and the perfection of many of the mechanical details, whose solution would be difficult for so young a contractor, doubtless owed much to him.

Harrison soon bought out Garret's interest and became a partner in the firm, which was known afterwards as Eastwick and Harrison. A visitor to their plant, then located at 12th and Willow Streets, wrote in 1843: "The first of the seven machines was practically completed at various workshops under the direction of Mr. Otis, the inventor; but finding some difficulty in organizing and fitting up so complicated a machine by this method he placed it in the hands of Messrs. Eastwick and Harrison, who skillfully perfected the details and gave such good proportions to the several parts that all the machines constructed, including the experimental one, have proven in practice to be completely successful."

Of the seven machines referred to above, four went to Russia, one to England, and two remained in the United States.

The earliest illustration of the Otis machine, as built by Eastwick and Harrison, was made in 1841 by S. Rufus Mason, a teacher of drafting in Philadelphia, and a relative of Otis. A reproduction of this drawing is shown below and on the front cover.

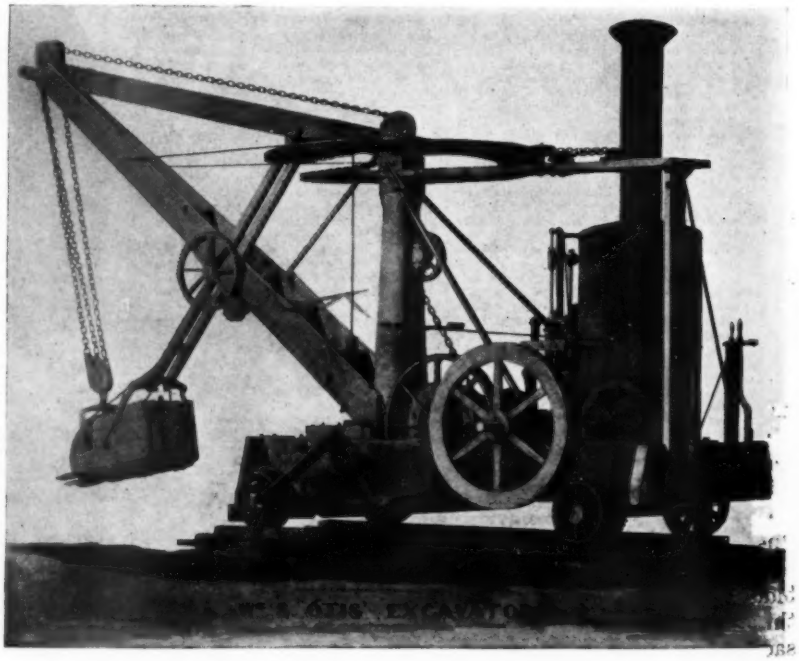
Drawings to England

Reproductions of the Mason drawing must have been sent to England, for in March 1843, an illustration of the Otis shovel appeared in print for the first time in the London Journal. This illustration (shown on page 180) conforms to the Mason drawing in every detail except for the addition of the two operators.

While the Mason drawing without doubt gives a very clear picture of the first shovels it is in perspective. Fortunately an English publication, desiring to describe in May, 1843, an Otis shovel, had a scale drawing made to accompany their editorial. This drawing (page 213) the article says, "was made by Mr. George Spencer from the original working drawings in his possession." The dipper of the shovel was frequently referred to as being of 1½ cubic yards capacity and from this scale given on this drawing it measured 3'2" x 4'0" front to back, dimensions which compare very favorably with modern dippers of similar capacity.

Controversial Caption

A photograph of Mason's drawing was presented to the Baltimore and Ohio Railroad some years ago. The donor, or some one, wrote as follows on the photograph:—"This shovel was first put to work on a section of the Baltimore and Ohio railroad in Maryland and later taken to



● *A copy of this photograph, presented to the B&O, had on it the caption which has caused so much confusion.*

● *What is believed to be the earliest printed report of the operation of an Otis shovel was printed in the Springfield (Mass.) Republican, in 1838.*

Canada and used on the Welland Canal. After that it was put on a scow and used as a dredge on the Sioux, it was finally wrecked in 1905 or 1906."

It is this information which has so often been quoted and has proven impossible to confirm. Unfortunately the author of these statements and the source of the information are unknown. Further information concerning this will appear in later pages.

If the Baltimore and Ohio Railroad was actually the first user of a shovel, it seems that it would have drawn attention to that fact at the time of its centennial. True, its records were lost in the Baltimore fire, but so far not even slightly confirmatory evidence of such "first use" by it is adduceable; and, further, there is no information indicating that it had any construction work of consequence under way during 1836 or 1837.

The first incontrovertable use of the steam shovel was on the Western Railroad of Massachusetts (now the Boston and Albany). The contracting firm of Carmichael, Fairbanks and Otis were in 1838 at work in Springfield, Massachusetts, finishing the link connecting Springfield and Worcester.

"B & O" or "B & A"?

In writing of the B & O and the B & A, the appearances of the "A" and "O" may become confused and in speaking, the sounds of the respective initials of the roads are quite similar, if at all slurred.

Trains began to run over this section October 1, 1839, according to a notice by George W. Whistler, Engineer. Bids were received April 15, 1839 for the adjoining section extending from the Connecticut River west to Chester, and these same contractors were among the successful bidders. It was while building this road through Westfield, Massachusetts, that Otis died on November 13, 1839, at the age of 26. Some accounts attribute his death to typhus and others to an accident while operating the shovel, although there is no confirmation of the latter belief.

The Republican.

SPRINGFIELD.
Saturday, May 19, 1838.

Western Rail Road.—Under the direction of the efficient Agent and Engineer, this work is going forward with spirit. Contracts were taken out the past week, for 32 miles of the Western R. Road, extending from Middlefield (through Pittsfield) to the west line of the State. A large number of responsible contractors were in town, and about 900 bids were offered, on the different sections. A part of this route is over the mountain, and is of course the most difficult to grade; but the work is to be done with all possible despatch. The other part of the road, from Middlefield or Chester, to the Connecticut River, will be contracted for in season for completion as soon as the mountainous part is done. From the river, east, it is expected the Road will be completed and in operation in about a year; and the section from Pittsfield to the New York line, in the same time. The intermediate part will take from six months to a year longer. Abundance of laborers are procured, we understand, at 85 cents a day, the board being deducted from that sum.

Upon the road in the eastern part of this town, is a specimen of what the Irishmen call "*digging by steame.*" For cutting through a sand hill, this steam digging machine must make a great saving of labor. A strong sheet iron scoop, holding about half a cart load, swings in a crane by chains, and is made, by the operation of the engine, to strike into the hill and fill itself by the winding of the chain. It then swings round over the cart, when the bottom, being fixed like a trap door, by the touch of a spring, drops open and lets all the sand fall into the cart. The machine will thus fill two carts as fast as they can be drawn off and emptied. Each cart-load is drawn by one horse on the temporary rail-way, to the neighboring valley to raise it to the proper level. Thus the hills are laid low, and the valleys made high.

After the completion of this contract the shovel was used on section No. 3 of the Schenectady and Troy railroad. The following quotation from the Troy Daily Whig is given in full because it is so graphic and is the first complete record of the shovel's manner of operation:—

"STEAM EXCAVATING MACHINE:

"The steam excavator, which has been at work for several months past upon the line of the Schenectady and Troy Railroad continues to excite a lively interest among our citizens, thousands of whom have been prompted by curiosity to pay it a visit. The triumphant success attending its execution in a material hitherto untried, and in which the skeptical had predicted it would be impossible to use it, has surpassed the most sanguine anticipations of its friends, and inspired the public with fresh confidence in its merits.

"It is most emphatically a labor saving engine—a novel and ingenious arrangement of the mechanical powers—another application of the one great revolutionizing agent, steam, to the useful purposes of life. It is an original idea and a universal good. It is one of those rare inventions, where genius seems to have marked out for itself an independent field of action, and the benefits flowing from which are destined to be known and felt throughout the civilized world.

"The utility of the machine is no longer a matter of speculation. In clay, sand and gravel, the materials most usually encountered in excavations of great magnitude, it has enjoyed the full tide of successful experiment, and its advantages, not only in the saving of labor, expense and trouble, but in the expediting of work are established beyond the possibility of doubt.

"The steam excavator was brought into use about four years since on the Western Railroad in Massachusetts. It was invented by William S. Otis, since deceased, a man of extraordinary mechanical genius, and a member of the well-known firm of Carmichael, Fairbanks and Company, railroad contractors. A patent right, embracing the most recent improvements, has been secured and the proprietors are now making arrangements for its use upon

a scale in some degree commensurate with the magnitude and merits of the invention.

Eight to Sixteen Horsepower

"The machines hitherto constructed, varying in power from eight to sixteen horses, have cost from five to seven thousand dollars. The one in use upon the Schenectady and Troy road is of the medium size, and is at work in fine compact marley clay of both the blue and light colored varities. It is estimated to do the work of fifty or sixty men. Only two men are employed in its operation—the engineer and conductor, or man at the shovel, wood and water being provided by other attendants.

"It is easy to conceive how varied must be the duties of a machine calculated to perform at once the offices of the pick-axe, the shovel and the man. A great variety of motions are required in breaking up the material, filling the shovel and depositing its burden in the vehicles which are to remove it from the excavation. All these the machine accomplishes with a most perfect regularity and precision. The trunk of the tamed elephant, as he quietly addresses himself to his master's bidding, is no inapt emblem of the grace, majesty and strength of its movements.

"At first glance the machinery of the excavator, from the novelty of its appearance, strikes one with the idea that it is extremely complicated in its structure, and hence, liable to be often deranged and thrown out of repair, and, withall, expensive of maintenance. But this illusion is soon dispelled.

"A more careful examination convinces us that simplicity is a chief attribute, and the first impression is followed by a sentiment of profound admiration at the display of mechanical ingenuity which has been exhibited in making so simple a combination of wheels, levers and chains, to perform so many and such varied operations.

General Construction Description

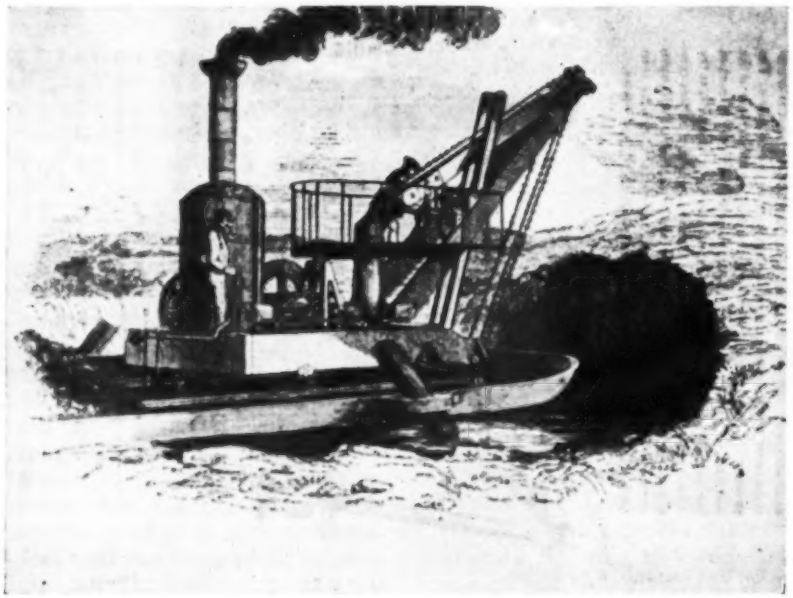
"It would obviously be impossible to trace the arrangements of the machinery through all their detail, without reference to drawings and models. We shall attempt however to give some general idea of its construction, and at the same time follow out the principles upon which its action depends. In the first place, then, the steam engine, boiler and connecting machinery, are situated in a strong carriage, resting upon a temporary railway track laid for that purpose. The shovel, which has a capacity of one and a quarter cubic yards, is suspended by a chain tackle of the ordinary construction, at the extremity of a sort of crane or boom projecting from the top of a mast about twelve feet high, which stands on the front part of the carriage, and over which the power acting through the tackle is communicated.

"The shovel consists of a square iron box with a handle of strong wood attached to the side in such a way as to give it the form and appearance of a ladle. It is armed in front with heavy wedge shaped teeth about eight inches long, which serve to break the material in advance of the shovel, and also to remove any obstacle which might come in contact with its edge. To follow the machine through a single round of its functions; the shovel is first brought to the bottom of the pit, in a position nearly horizontal, with the handle projecting upward and passing through the brace work of the crane by which means a steady action is at all times secured.

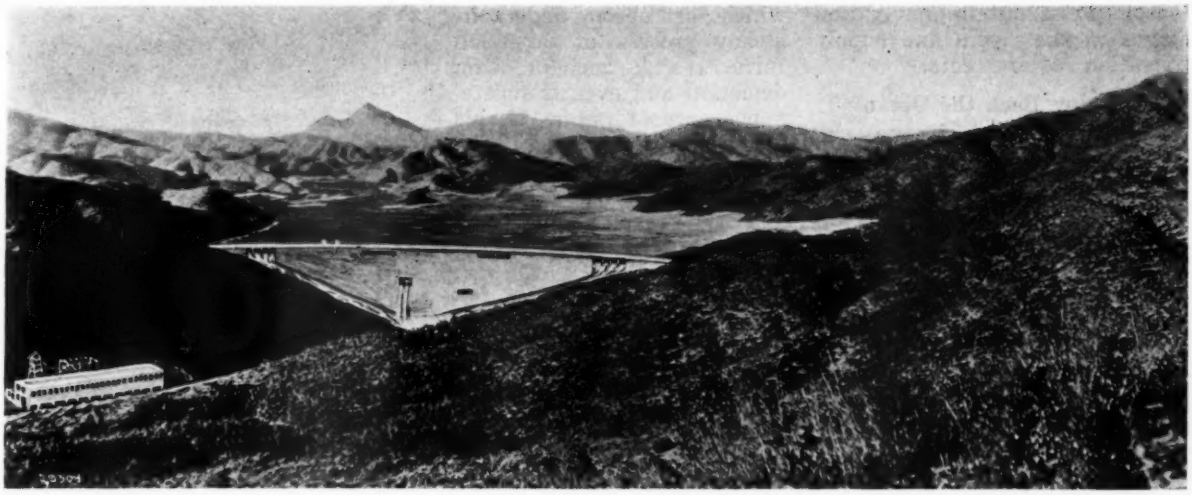
"The chain tackle, acting from the end of the boom, and attached to the shovel by a ball and pivots, and deriving its power from a grooved windlass on the carriage around which the chain winds, then commences to draw the shovel forwards and upwards, while another chain made fast at the end of the handle and winding in the same manner on a drum situated in the brace work of the crane near where the handle passes, serves to press the shovel against the face of excavation in its upward passage, and thereby to regulate the depth to which it penetrates.

"This latter chain is so adjusted, by means of a friction wheel and levers, as to exert just so much power at any instant as the operator may choose to apply. The friction wheel also protects the shovel and other machinery from any unforseen danger; for as all the power which

(*Continued on page 212*)



● *Drawing showing an Otis shovel mounted on a dredge. This machine, used in England in 1845, incorporated certain improvements made by J. B. Hyde. Note how revolving mechanism has been lowered.*



● *Drawing of Kennett Dam and Reservoir as they will appear when completed. Enough water will be stored here to flood New England and Pennsylvania to a depth of ¼ ft.—it will be used to service half of California.*

Central Valley Project Moves Ahead

Preliminary construction surveys are being made on $170,000,000 reclamation project in California to permit work to start soon.

By **KHYBER FORRESTER**

CALIFORNIA'S huge Central Valley reclamation project, after ten years of planning, is at last under way with an initial appropriation of $15,000,000. The Federal government, originally authorized an allotment of $20,000,000, later reduced to the above sum.

The total cost of the series of first stages of this plan will be about 170 million dollars, with future generations expected to make additions as required to meet changing conditions.

The Great Central Valley of California is an oblong cup, completely surrounded by mountains except for the narrow pass at the Golden Gate, and the equally narrow pass at the extreme south of the valley, known as the Tejon Pass. This mighty valley, through long ages of prehistoric time and geological epochs, was the bottom of an inland sea. It has been sea bottom for longer periods than it has been exposed.

A great split in the Rocky Mountains, with the Sierra Nevadas on the east and the Coast Range on the west, cups the valley.

No New Irrigation Planned

The valley floor is a flat alluvial plain 500 miles long (various extensions add many miles to the practical continuity of the valley), and 30 to 60 miles wide between the foothill ranges. It contains 9,000,000 acres of agricultural land of fine quality. While, under plans now formulated, no new portions of it will be placed under irrigation since it is felt there is already enough land being cultivated, many thousands of acres ruined because of the depletion of water resources will be restored to life.

This great valley is the commercial and agricultural back country which adds greatly to the financial activity of San Francisco and Los Angeles. The northern portion is drained by the Sacramento River; the southern portion by the San Joaquin. Both rivers flow toward the pass at the Golden Gate.

According to the general plan, a series of dams and reservoirs, located in the mountains forming the eastern boundary of the great Central Valley, will impound flood waters in the winter and spring, preventing disastrous floods along the Sacramento and San Joaquin Rivers, and then release this water during the dry

● *This was once a prosperous ranch—$50,000,000 worth of such property in the Central Valley has been practically deserted because of aridity. The vines and orchards may bloom again, however, when the new dams are completed.*

season to maintain navigation stages in the rivers and supply irrigation requirements.

Keeping Back the Ocean

Finally the heads of water in the two rivers which converge in the San Francisco Bay area through a common delta, will serve their last purpose in driving salt sea water out of parts of the delta region into which they have penetrated, thus forming a counter flow of fresh water to resist the present tendency of the sea to permeate delta lands which are being lost to agriculture.

While the plan is termed a "reclamation" project, it actually is intended to restore a vast acreage of land which, until recently, produced a rich agriculture but which has been undergoing a steady process of desertion by farmers and ranchers owing to depletion and even complete disappearance of water. If this depletion of water resources were permitted to continue, these areas would eventually become deserts and the result would be felt throughout the country, not only because of the lack of crops produced but in lost business as well. Already 40,000 acres of highly developed farm land in the southern San Joaquin Valley have been abandoned, and another 160,000 acres will suffer the same fate if remedial measures are not undertaken soon.

Deserted Homes and Highways

From the highway standpoint, if this plan had not been put into effect, it is probable that only the main trunk highways would have eventually remained of the vast system of trunk and feeder highways which now serve those parts of the valley producing crops and those which have been deserted.

● *Diagram of Central Valley project of California state water plan. Winter flood water will be stored in Kennett and Friant Reservoirs for use in the dry season.*

● *Like the Mississippi, the Sacramento does a devastating job when it floods. The new state water system, with numerous dams and reservoirs will prevent scenes like this.*

One can motor for scores of miles in some sections, viewing only abandoned ranches with costly homes and structures lying vacant, and about them tens of thousands of fruit trees now dead and dry. However, many of the former owners will never return for their property has passed to other hands, notably banks and finance houses, who have resisted receiving the property for its return has meant only loss to them. The most humane financing known was practiced, but since a bank is not a water plant, fate had to take its course.

To Relocate Highway and R. R.

At the northern end of the system, where a large reservoir and dam with a storage capacity of approximately 3,000,000 acre feet will be located, known as Kennett Dam and Reservoir. A California State Highway passes through the reservoir site, and like the contiguous Southern Pacific railroad, is to be relocated. The estimated cost of this work is $5,000,000.

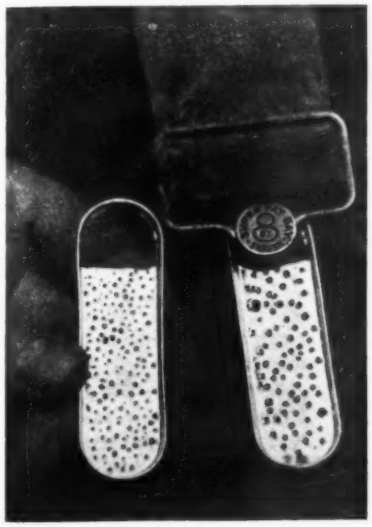
Direct highways to the major dams are necessary both for movement of personnel and materials, and for subsequent use by tourists, since the dams will un-

(*Continued on page 208*)

Field Notes

Handy Homemade Outdoor Match Scratcher

CIGARETTE lighters and the small impregnated matches are of course handy and convenient indoors, but generally of little use outdoors. It takes the long kitchen match with plenty of fire in its make-up to start the



pipe, cigarette, or start a fuse nicely in time to "scratch and git." Such a match is also more handily cupped in the hands against the wind when lighted. Scratching them is often the problem, especially when everything around you may be wet, on rainy days. Carefully remove the bottom of an ordinary tobacco can. With a small block and with an awl, sharp prick punch or other pointed tool make a mass of light perforations, raising the thin tin into something of a rough abrasive surface, or grating, on the inside of the burring rim. Hook this over the shoulder strap button of the overalls on either the right or left side. There it is, handy and right where you can conveniently touch and draw the match over it. The bottom of the device is of course perfectly smooth and cannot injure the fabric of any clothing. The raised burring prevents the hand or anything else from coming into contact with the rough side. Even if wet, this will "take 'em."

—*Frank W. Bentley, Jr.*

New Splint for First-Aid Treatment of Broken Legs

A MAN with a broken leg is always difficult to handle. He is powerless to help himself, and he cannot be moved without great suffering and, possibly, further injury, unless the fractured limb is properly braced and supported.

An improved type of leg splint, known as the Greene Traction Splint, has been developed especially to enable industrial first-aid workers to take care of such cases easily and effectively.

The longitudinal members of the splint are made of wood, which is preferred to steel because X-rays of the leg can be taken without removing the splint. The upper end of the splint is formed by a half ring of laminated wood, reversible for either leg, and the lower end by a crosspiece of metal in which is mounted a hook which can be drawn forward by turning a wing nut.

With the half ring lying flat, the splint can be put in position with minimum movement of the injured leg. The half ring is fitted around the thigh, its design being such that it does not cut off circulation, and the leg is tied to the sides of the splint by triangular bandages at the thigh and the ankle. The ankle bandage is then connected to the hook in the cross piece by a strong cord, and traction is applied to the leg by means of the wing nut. Four more supporting bandages—two above and two below the knee—are then put on, and more traction is applied as needed. Finally, the splint is raised and a metal foot rest is attached to the cross piece, which insures a comfortable position for the injured leg. The subject can now be carried on a stretcher, or even in men's arms, and transported in a car without excessive discomfort.

The Greene splint weighs only 7½ lbs. complete and can be compactly packed in a flat case. Wooden parts are of the best quality birch, and metal parts of a non-rusting alloy. A few minutes training will enable any intelligent man to apply it properly. It was developed by Harold Greene, of the Aetna Life Insurance Company, with the cooperation of Dr. Harry Archer, Chief Surgeon of the New York Fire Department, and Dr. Robert H. Kennedy, of the American College of Surgeons. The Davis Emergency Equipment Company, New York, are distributors.

Latch Lift for Homemade Machine Builder

LEVERS and quadrant arrangements are not a difficult thing to find and assemble from odds and ends by the homemade machine builder. One thing however that almost stops operations at times and is hard to make of anything with a limited assortment of tools is a latch lift handle. A common removable shovel foot plate or protector can be neatly and easily made into the required part as shown. Only one small hole need be made in it, and that for the end of the lift rod or wire. The sides or ears of the plate can be easily bent to fit the width of the top of the lever. This makes a very practical

latch lift, easily and safely covered by the fingers and which goes neatly over the lever end as it is moved in either direction.

EXCAVATING ENGINEER

A Monthly Publication Devoted to Excavating and Allied Subjects

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The Business Situation

THE STRENGTH of prevailing business confidence is very favorably shown by the reactions of the stock market to recent developments. Except for brief flurries the stock market almost disregarded the decision on the TVA case and the order of the Interstate Commerce Commission for reduction of passenger fares. In the closing days of February the stock market experienced the first self-generated technical reaction in almost a year. This reaction, caused by spontaneous profit taking, lasted for only two days and then renewed buying almost fully restored former prices on the third day. In the bond market a great oversubscription of the huge offerings of federal securities in early March was even more significant. Re-financing is going forward generally on a large scale. While these developments reflect easy money rates, they also tell a significant story of the increase of the red corpuscles in the arteries of business.

During January and February of this year there was a rather sharp decrease in business activity that brought industrial production down about 10% below December. Recent statistics indicate that this decline has been, or will shortly be, overcome. In part it was caused by the natural reaction from unusual activity in the closing months of '35, and in part by the exceptionally severe winter weather.

Probably the most serious danger on our present business horizon is the mounting extravagance of our governmental bureaucracy and an increasing public debt. This probably now totals, including the National plus State and Local government debts, somewhere in the neighborhood of $50,000,000,000, although our National debt is only about $30,000,000,000. Already this mounting total is forcing consideration of dangerous and disturbing tax measures in an attempt to make revenues keep pace with increasing governmental spending.

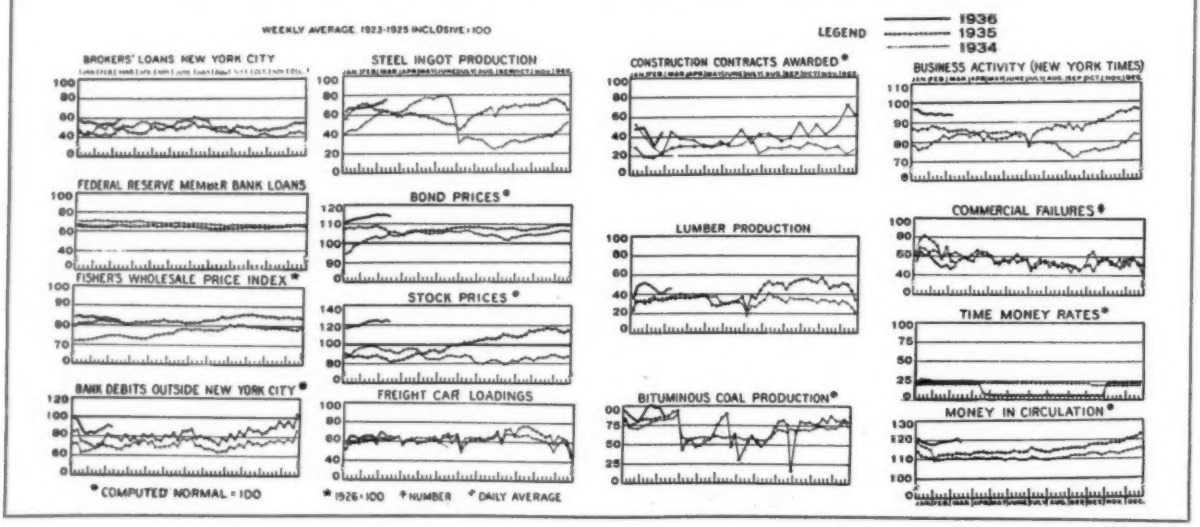
Business in the construction field is showing continued and substantial improvement. The shortage of modern housing is being more generally felt and the fear psychology which has interfered so seriously with building throughout the nation, is giving way to confidence as indicated by rising construction totals. Larger sales volumes have encouraged industry to go ahead with plans for modernization of plants and equipment. Manufacturers of contracting and mining equipment report that the last few months have shown the best sales volume in many years. Some leading manufacturers are having trouble accelerating production fast enough.

Construction 90% Ahead of '35

THE construction industry continues to record large gains over the comparative levels of 1935. For February a contract total of $142,050,200, covering all branches of construction, was reported by F. W. Dodge Corporation for the 37 states east of the Rocky Mountains. This was practically 90 per cent larger than the total of only $75,047,100 reported for February, 1935. Partly because of the unusually low temperatures and heavy snows the February contract volume was about 30 per cent lower than the total of $204,792,800 registered for January of this year.

Residential building under-

WEEKLY BUSINESS INDICATORS



taken in the 37 states during February amounted to $31,175,500 as compared with only $16,616,800 for February, 1935 and $37,439,500 for January of this year.

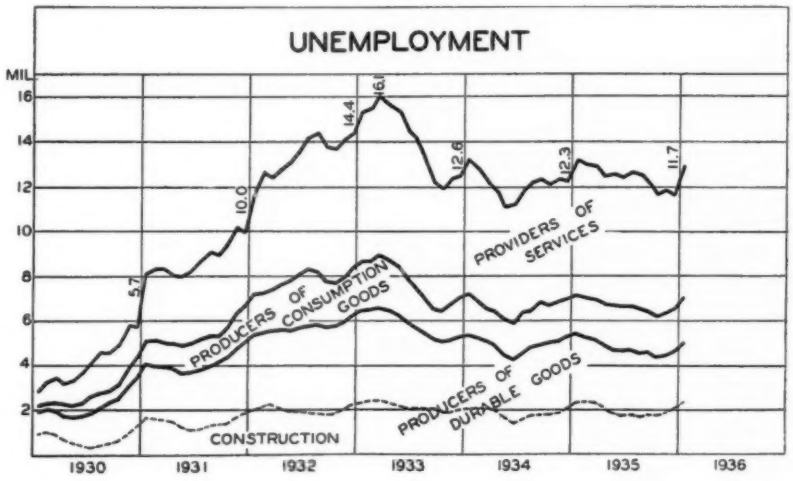
Gains in residential building over last year were scored in each of the 13 major districts in the area east of the Rockies, excepting only Upstate New York and the St. Louis territory (So. Illinois, Western Tennessee, Eastern Missouri, Arkansas).

Total construction for the first two months of 1936 amounted to $346,843,000 as against only $174,821,000 for the corresponding two months of 1935 a gain over last year of 98 per cent. For residential building alone the contract volume for the first two months of 1936 totaled $68,615,000 for a gain of 76 per cent over the total of $39,027,000 for the corresponding two months of 1935.

Unemployment

CHANGES in unemployment during the past six years are shown on the accompanying diagram, prepared by the Cleveland Trust Company. General unemployment at the end of 1935 is shown at 11,700,000. The figure for January was 12,900,000. Those engaged in emergency relief work such as CCC and WPA are considered as unemployed. The figures include allowances for the estimated increase in the number of persons of working ages in the population.

It is highly significant that one half the unemployment is caused by the other half. If we could return the producers of goods to work and keep them employed, the providers of services would automatically go back to work. The controlling factor of unemployment among producers is still the durable goods industries. This is the key to our depression problem.



Joseph R. Swigart

IT IS WITH sincere regret that we record the death of Joseph R. Swigart on March 10, 1936, at West Bend, Wisconsin.

Mr. Swigart was born in Bucyrus, Ohio, on June 14, 1873. He became active in the construction industry at an early age and for some time served as an erecting engineer and subsequently sales engineer for The Bucyrus Company, of South Milwaukee. In 1903 he organized the Atlas Construction Company, which was formed to do railroad construction work. This company was active for a number of years. Its first piece of work carried on in 1903 and 1904 was a subcontract under McArthur Brothers for railroad construction on the Baltimore & Ohio Railroad at Ravenna, Ohio. Later a large contract was undertaken under Mr. Swigart's management at Decatur, Illinois.

He was one of the first to apply dragline excavators to railroad construction work and he took contracts under the Chicago, Milwaukee & St. Paul Railroad for construction work at Sabula, Iowa, and for the Illinois Central at Effingham, Illinois, and other places. He was engaged in the construction of sewers and drainage canals for the Oliver Iron Mining Company at Hibbing, Minnesota. Later he built part of the Edgewood cut-off for the Illinois Central in Southern Illinois and following that the J. R. Swigart Construction Company built the Wabash yards at Montpelier, Ohio.

He spent much time as a consulting engineer, giving advice on problems in earth handling and rock excavation for rock quarries.

For several years prior to his death, ill health prevented an active business life. Mr. Swigart is survived by two brothers, George S., of Carbondale, Colorado, and Carl A., of Los Angeles, California.

B. E. Merrell

B. E. MERRELL, superintendent of the Leeds, Alabama, plant of the Universal Atlas Cement Company, died at his home on March 4, after a brief illness.

Mr. Merrell was a native of Ohio. He had been connected with the Leeds plant since 1919, had been superintendent for the last eight years. His death at the age of 51 is a real loss to his coworkers, and to men in the field.

Quality and Value

NEXT TIME you get into a discussion on the relative value of products that are seemingly alike in appearance or that have a similar chemical make-up, ask this question:

"Which would you rather have —a diamond weighing one pound, or a lump of high grade coal of the same weight?"

Chemically there is no great difference between a diamond and good coal. Carbon is the principal ingredient in both. Yet the value of a one-pound diamond is given as $750,000 while high grade anthracite, at $12 per ton, is worth only 0.6c per pound.

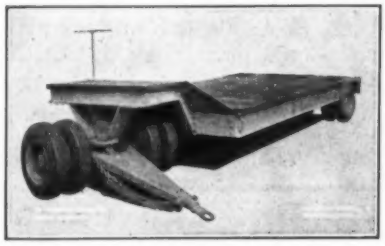
Using these figures you can readily determine that a one-pound diamond is worth 125,000,000 times its equal weight in coal. Or, putting it in another way, a one-pound diamond will buy 62,500 tons of coal at $12. per ton.

Quality **does** have considerable influence in real value.

EQUIPMENT
You Ought to Know About

Announce Two New Heavy-Duty LaCrosse Machinery Trailers

THE C. R. JAHN COMPANY, LaCrosse, Wisconsin, announces two additions to its line of LaCrosse Machinery Trailers for transporting shovels, tractors, road-rollers, and other contracting equipment. One is a four-wheel trailer designed for loads up to 12 tons, and the other, with six wheels, is designed for loads up to 18 tons. In both of the new models, the main beams extend the full length of the trailer and are shaped without cutting top or bottom flanges at the front deck. The front deck is raised to clear the front wheels, to permit a full right angle turn of the front axle. The frame is further strengthened by tie plates at each of the numerous cross members.



The four-wheel trailer has a rigid mounted rear axle; while the six wheel type has two independent oscillating type axles that are so arranged that the four wheels adjust themselves to the irregularities of the road. With this construction, each wheel carries its share of the load at all times.

Both models feature the oscillating front axle, another of the exclusive developments in LaCrosse trailers. This arrangement eliminates the necessity of front springs and provides greater flexibility and ease in turning.

The brakes are of the mechanical, internal expanding type and are available for vacuum or air operation.

Over-sized taper roller bearings are used throughout. The loading height of trailer, only 29 inches.

The trailer width of 8 feet conforms with the highway regulations of all states. Solid or pneumatic tires are furnished on specification.

Novo Two and Four Cylinder Model C Engines

A NEW LINE of engines, on test for two years, has been announced by Novo Engine Company, Lansing, Michigan. The horsepower delivered by these two- and four-cylinder engines, in proportion to their piston displacement, is in keeping with the modern trend and is held at the maximum by anti-friction bearings throughout, proper piston fit, adequate lubrication, correct cylinder head design, coordinated valve timing, well proportioned manifolding and many other features which should be incorporated in the design of an industrial engine.

The maximum torque of the Model C engines is so placed in respect to the normal speed to make them ideal industrial engines and what is known in the industrial field as "luggers." They will not stall when the load comes on but stay "right in there" and carry it over the peak.

The C Line of Engines will at first be composed of two 2-cylinder engines, 2¾x4 and 3¼x4 and two 4-cylinder engines. 2¾x4 and 3¼x4. Cooling is radial with thermo-syphon circulation, although waterpump circulation may be added. Crankshaft and cam shaft are ball bearing equipped. They may be equipped with battery ignition when electric starter and generator are specified. The manufacturer will gladly send circular on request. Use one of the handy post cards bound in this magazine.

Caterpillar Tractor Grader

DECLARED to be the only one of its size in the field, the No. 22 tractor grader has been announced by Caterpillar Tractor Company of Peoria, Ill. Hitherto, the only graders below the 5,000-pound class were horse-drawn machines.

The new product has an 8-foot blade and weighs 3,575 pounds. It contains all of the design features offered in the four larger models, according to the manufacturer. Advantages include welded box frame construction, adjustable tractor pole, leaning wheels and an extensible lift link for extreme blade positions. Its flexibility makes it equally adaptable for construction, ditching or maintenance work.

Built to match tractors between 20 and 35 horsepower, the No. 22 grader is expected to render a new service to road networks of townships and smaller cities.

(Continued on page 206)

POST CARD

This side for address only

Place Stamp Here

POST CARD

This side for address only

Place Stamp Here

Date_____ 193____

Gentlemen:—I have read your advertisement in EXCAVATING ENGINEER and would like the following information:

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Name_____

Address_____

Business_____

Date_____ 193____

Gentlemen:—I have read your advertisement in EXCAVATING ENGINEER and would like the following information:

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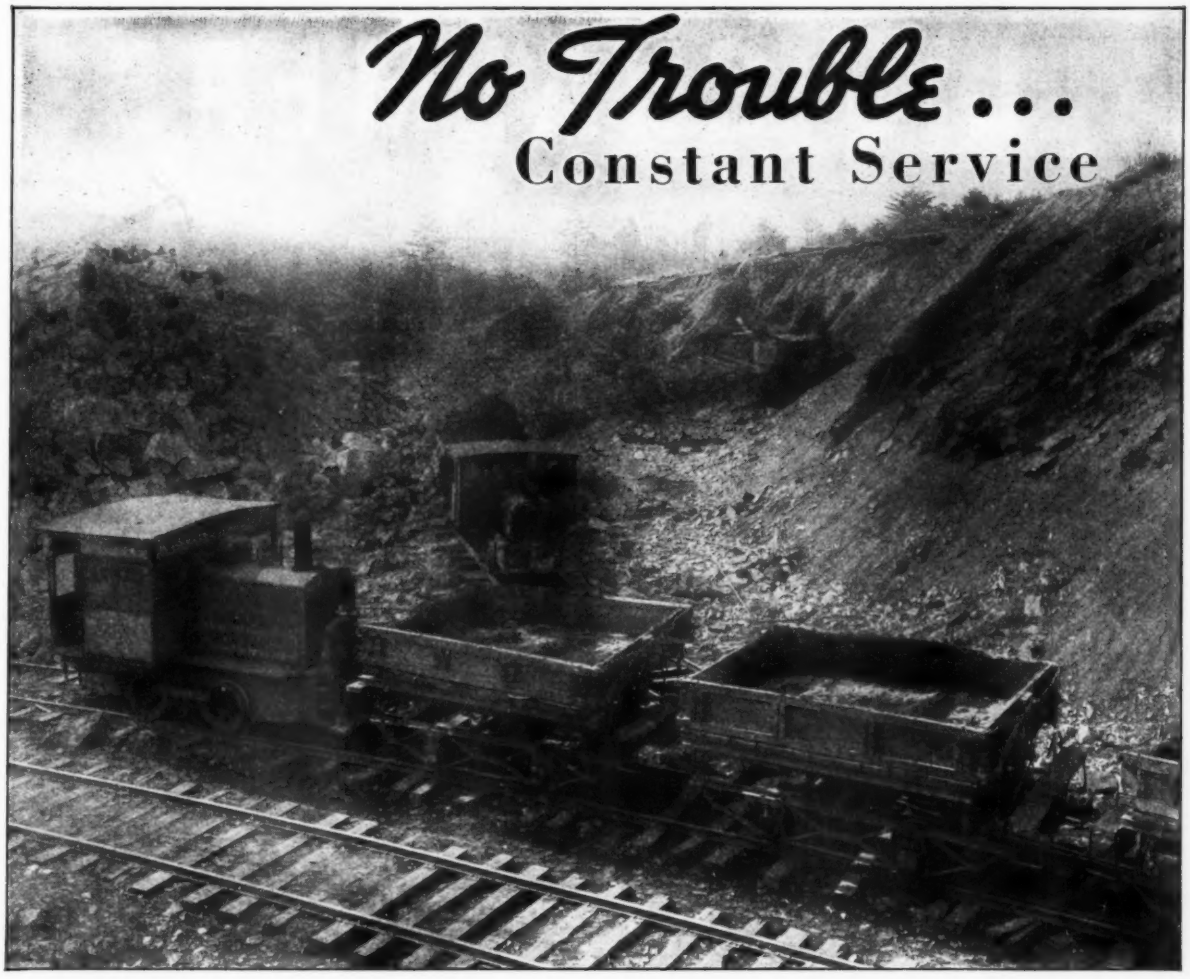
Address_____

Business_____



VOLUNTEER PORTLAND CEMENT CO., Knoxville, Tennessee bought a Whitcomb 25-ton gasoline mechanical locomotive in 1927 soon after its organization and has used it constantly since then, first in building the plant, and subsequently in hauling overburden, rock and shale. A year later the company bought a Whitcomb 12-ton gasoline mechanical locomotive, and these two locomotives have handled the entire haulage of this plant to the entire satisfaction of their owner.

INTERNAL COMBUSTION:
GASOLINE OR DIESEL
Mechanical drive 2 tons to 30 tons
Electric drive .....30 tons and up
ELECTRIC
Storage Battery 1¾ tons to 10 tons
Trolley .....4 tons and up
Combination .....6 tons and up

Let us show you what modern Whitcombs will do—designed and sold by Baldwin; built by Whitcomb under Baldwin management. Make your selection from the most complete line of locomotives available anywhere.

THE BALDWIN LOCOMOTIVE WORKS
and
THE WHITCOMB LOCOMOTIVE COMPANY

SUBSIDIARY OF THE BALDWIN LOCOMOTIVE WORKS. PLANT AT ROCHELLE, ILL.

ALL SALES MADE BY

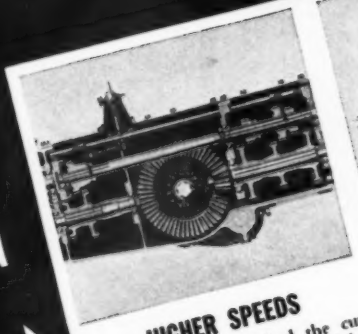
THE BALDWIN LOCOMOTIVE WORKS

PASCHALL P. O. STATION, PHILADELPHIA

For your convenience in writing to The Baldwin Locomotive Works, you will find a card bound in this issue.

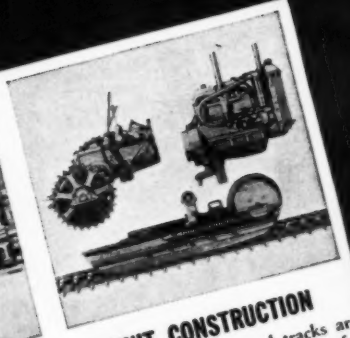
ALLIS-CHALMERS LE

TYPICAL EXAMPLES OF ALLIS-CHALMERS LEADERSHIP IN TRACTOR DESIGN



HIGHER SPEEDS

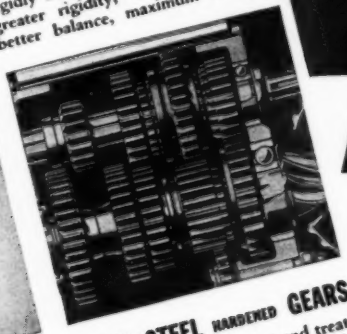
Allis-Chalmers established the current trend to lighter weight, higher speed tractors—which do more work per hour, and per dollar invested.



UNIT CONSTRUCTION

Engine, transmission and tracks are rigidly bolted together as units—for greater rigidity, correct alignment, better balance, maximum strength.

AND



NICKEL STEEL HARDENED GEARS

Experience in the selection and treatment of metals for over three-fourths of a century enables Allis-Chalmers to produce the finest gears made.

ROLLER BEARINGS

Instead of plain bearings or bronze bushings for truck rollers, front idlers, etc., Allis-Chalmers uses more efficient, wear-resisting roller bearings.

REMOVABLE CYLINDER SLEEVES

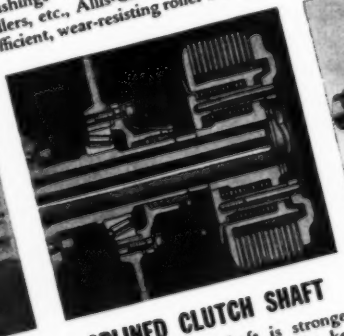
Separate, removable sleeves of tough nickel iron. Longer life. Greater cooling efficiency. No expensive reboring—inexpensive to replace.

INSERTED VALVE SEATS

Exhaust valve seats have hardened steel inserts—more resistant to heat, corrosion and wear. Save grinding; save fuel—exclusive with A-C.

FIBRE TOOTH DISCS

No metal wears on metal in A-C multiple disc steering clutches. Noted for satisfactory service, long life, and minimum replacement.



SPLINED CLUTCH SHAFT

The A-C splined shaft is stronger and more dependable than the key construction commonly used. Steering clutches easily accessible.

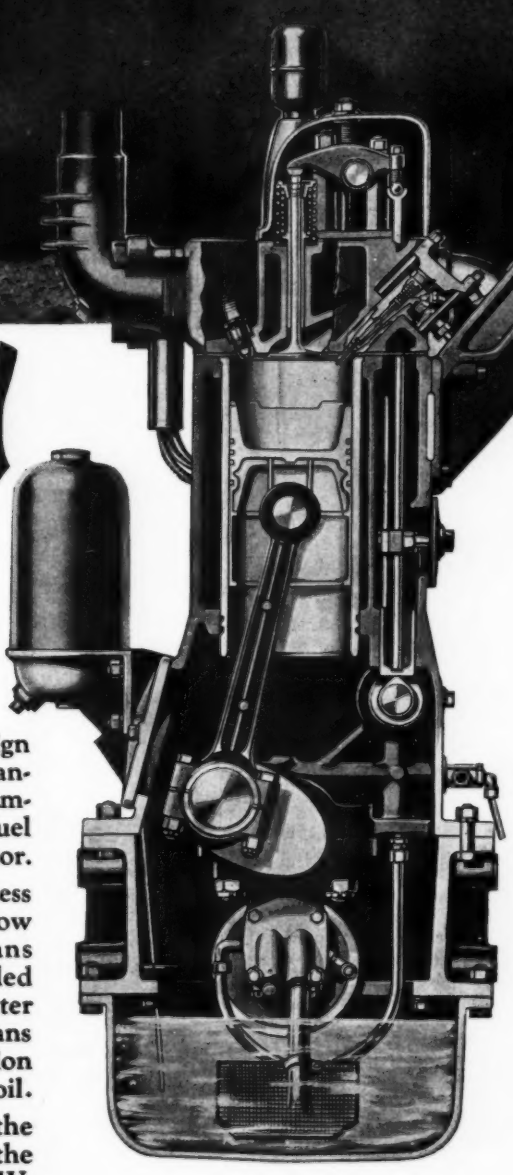
CONTROLLED ALIGNMENT

The crank type stabilizer, exclusive with A-C, keeps tracks in perfect alignment—yet permits extreme flexibility. Saves track wear; absorbs jolts.

REINFORCED TRANSMISSION CASE

Exclusive design Greater strength without excess weight. Easier servicing—makes working parts accessible without removal of adjoining parts.

EADS THE WAY...



NOW... Controlled IGNITION

NEARLY every recent improvement in tractor design was pioneered by Allis-Chalmers. *Now* comes another outstanding advancement—the first tractor to combine gasoline engine simplicity and smoothness with fuel oil economy—the A-C *Controlled Ignition* Oil Tractor.

Controlled Ignition means smoother operation, less vibration and less maintenance—because of the low compression pressures. Controlled Ignition means instant starting, regardless of weather. Controlled Ignition means simpler design, less dead weight, greater flexibility, better balance. Controlled Ignition means lower first cost and greater value. Controlled Ignition means efficient *Controlled* burning of Diesel fuel oil.

Controlled Ignition is unquestionably the design of the future. But why wait until others have followed the lead of Allis-Chalmers? Enjoy these advantages NOW.

ALLIS-CHALMERS OIL TRACTORS

TRACTOR DIVISION—MILWAUKEE, U. S. A.

SHOTS *from the Firing Line*

Work to Start on Provo River Project

THE BUREAU of Reclamation has received approval by Secretary of the Interior Harold L. Ickes of an arrangement which will permit an early start on the $7,900,000 Provo River project in Utah.

Original plans for the project called for an estimated total cost of $10,000,000. However, the $2,100,000 Duchesne River tunnel has been eliminated because the Metropolitan Water District of Salt Lake City, which originally desired to obtain a supplementary water supply from the Deer Creek Reservoir, has not reached a final decision on its participation.

Under the original plan the unused waters of the Duchesne, Weber and Provo Rivers were to have been gathered behind the Deer Creek dam which will cost about $3,650,000. This plan would have developed about 100,000 acre-feet of water annually for use in areas east of Utah Lake and of Jordan River and for the city of Provo and the Metropolitan Water District.

With the elimination of the Duchesne tunnel, about 68,000 acre-feet of water will be developed annually for use by Provo and the irrigators whose lands have been in need of a supplemental supply for several years.

In the event the Metropolitan Water District should in the future care to participate in the project, a supply of water could be developed for it by construction of the Duchesne tunnel at that time, provided the water has not been put to use elsewhere in the meantime.

The total cost of the project, as now planned, will be about $7,900,000, of which the Deer Creek Division will take $4,800,000. The Public Works Administration allotted $1,000,000 to commence the work, and subsequently an allotment was made for the project from work relief funds.

Under the regulations governing Bureau of Reclamation construction, work can be begun when 80 per cent of the water is subscribed for and prospects are good for the disposal of the remainder. Repayment contracts for more than 80 per cent of the revised Deer Creek Division have been tentatively approved by prospective water users. Concerning the rest, Acting Commissioner John C. Page said:

"The Bureau of Reclamation has requests for the use of the water for which subscriptions have not been received. No difficulty is anticipated in disposing of the 68,000 acre-feet the Deer Creek reservoir will develop without the Duchesne feeder tunnel. Studies are under way now at the Deer Creek damsite and preliminary designs are in progress. Actual construction will be started shortly."

An early start will also be made on the Utah Lake Division.

Excavation Completed on Three Tunnel Units at Colorado River Aqueduct

EXCAVATION of three major tunnel units of the Colorado River Aqueduct was completed last month at widely separated points along the far-flung aqueduct system.

After almost three years of steady labor, Winston Brothers' tunnel crews drove through to daylight at the west end of Coxcomb tunnel, 200 miles east of Los Angeles. This three and one-half mile tunnel was the longest to be driven from one portal (except for 40 feet of top pilot drift which was driven in from the west portal). Concreting operations will not be launched on this until similar operations are completed on the East Iron Tunnel (About 3000 feet of the 23,000 total are so far lined).

Right on the heels of this event came the holing through of two major sections of the giant 13-mile San Jacinto tunnel when excavation was completed of the three miles from West portal into the west leg of Potrero shaft. Excavation, of course, will continue east from the base of Potrero shaft and in both directions from the base of Cabazon shaft, as approximately 7 miles remains to be driven from these points. But, the breaking through between Potrero and West portal will facilitate drainage of the tunnel by allowing seepage water from Potrero shaft west to flow out of the tunnel's end without the necessity of heavy pumping. Concreting operations on the westerly end of the shaft will get under way immediately.

Witnessed by city officials of both Los Angeles and Pasadena, and members of the board of directors of the District, the L. E. Dixon, Bent Bros. and Johnson crews broke through to daylight at the east end of the 3-mile Pasadena tunnel of the aqueduct distribution system. This bore passes beneath the thickly populated section of the city of Pasadena with its west portal in the Arroyo Seco, near the Rose Bowl. Work on the tunnel was begun Feb. 21, 1935 under the supervision of H. J. King, general superintendent for the company and was completed almost exactly a year later. Concreting begins immediately.

Work Picks Up at Fort Peck

ANOTHER definite step toward full scale activities for the 1936 construction season at Fort Peck was taken recently when the Massman Con-

● *Mucking out the West Portal of Coxcomb tunnel just after the holing through was done with this TE-5 Bucyrus-Erie tunnel shovel, owned by Winston Brothers Company.*

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Fuse, blasting	☐ Welding machines
Graders	☐ Welding rods
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Jacks	☐ ____
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m interested in the purchase of a (size)____yard,
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struction Company started full-time operations at the spillway. Monday, March 16th saw work commence on a 3-shift basis and it is expected that a 24-hour schedule will be followed throughout the season. Three shovels and 30 dump trucks are stripping off the eight-foot cover which was left above grade from last year's excavation as protection of the shale against weathering during the winter. About 200 men have been called back to work and more will be needed as the stripping progresses so as to give working space for subsequent operations.

First a network of drainage ditches must be dug in the base of the channel. Two new electric channeling saws have been received for use in cutting the sidewalls of the ditches. Another larger machine for making horizontal and inclined cuts is on the way. As the shale is broken up by machine and hand-trimmed down to finished grade the debris will be loaded into trucks by two pull-shovels or trench hoes. The dippers and booms have been removed from two power shovels and two new 1½-yard pull-shovel attachments are being installed in place of them. The new concrete mixing plant will be tried out and calibrated and will then be ready for the demands of the summer. Form lumber, drain tile, reinforcing steel bars and other materials are rolling in for the job. Full-scale operations at the spillway this spring and summer will be most interesting.

Since the evening of March 10th the Missouri River has gone down 5½ feet at Fort Peck. Reports indicate that the tributaries above the dam are practically clear of ice and that, in the main stem below Power Plant Ferry, the ice has started to break up. It is hoped that the present warm weather will start it on its way down the river so that dredging can begin soon. However, in a portion of the area between the winter harbor and the intake to the town water system, the ice was more than two feet thick March 16. It is in this area that the dredges are scheduled to start digging this year. If the flow of the river continues to drop, it will probably delay the breaking up and flowing away of the ice.

All-American Canal Reaches Half-Way Mark

APPROXIMATELY half the excavation required by the All-American Canal has been completed, according to a recent report by John C. Page, Acting Commissioner of Reclamation.

A total of 30,503,947 cubic yards of material has been excavated to date in construction of the world's largest irrigation ditch. This would make a pile two miles high on an ordinary city block.

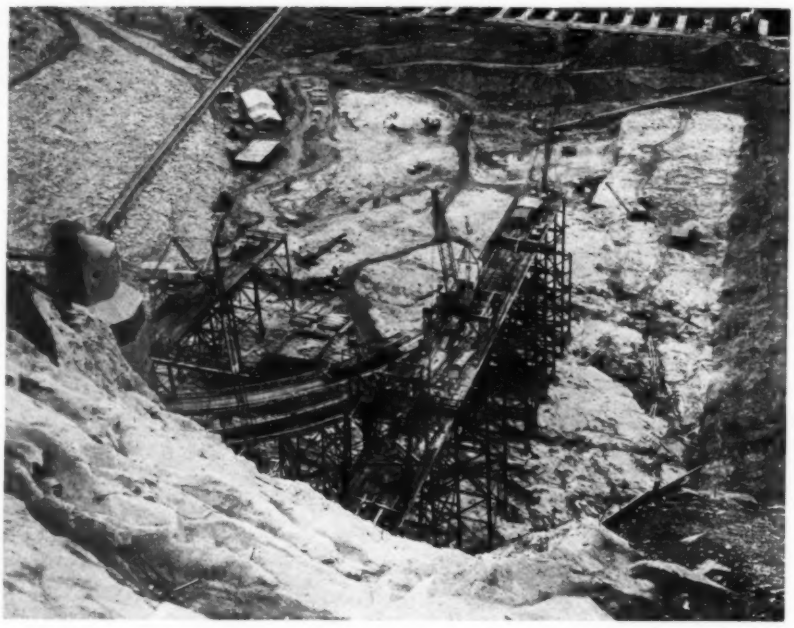
The All-American Canal will serve the rich Imperial Valley of California, replacing the present main canal which crosses from the Colorado River to the irrigated section of the valley through Mexico for more than 50 miles.

The first shovel of earth was moved in this construction December 16, 1934. Employment on the job has increased steadily until, on March 1, a total of 1,312 men were at work. This is an increase of nearly 400 men over February 1. Of the new employes, 357 are at work on the Imperial Dam and Desilting Works, the structure being built at the head of the canal in the Colorado River about 15 miles above Yuma, Arizona. Work is now getting under way on this feature of the project, the contract having been let late in December.

The All-American Canal will have an initial capacity of 15,000 cubic feet of water per second, and a capacity of 10,000 second-feet for most of its length while crossing the desert of the East Side Mesa. It will be 80 miles in length. It is designed to carry water to irrigators now farming 500,000 acres of land reclaimed 35 years ago from America's most forbidding desert. While there are approximately 350,000 potentially irrigable acres on the East Side Mesa and in the southern end of the adjoining Coachella Valley that can be served by construction of a branch of the All-American Canal, present plans do not include construction of this branch nor irrigation of any additional lands.

Work is now under way on all the major features of the canal, except a siphon near Calexico to carry the stream across the New River gorge which was cut by the flood of 1905-6 when the Colorado River broke its banks. Designs for this siphon are now being prepared at the Denver engineering office of the Bureau of Reclamation.

Numerous canal turn-outs, gates and checks, bridges and less important structures also are being designed in Denver. Construction of many of these must await excavation of additional sections of the canal.



● *Workmen busy at the excavation in Block 40 at the Grand Coulee dam. Well below the river level, block 40 has been well timbered and supported while it is being prepared for the pouring of concrete.*

● *Thirty yards at a bite! Here is the giant dipper of Brinkley Coal Company's Bucyrus-Erie 950-B in action. Tooth marks on bank face indicate where the 30-yard stripper has been working.*

Continue Federal Aid for Highways

IN HIS budget message to Congress, the President recommended that the authorization of $125,000,000 for Federal aid for highways for fiscal year ending June 30, 1937 be cancelled and made applicable to the fiscal year ending June 30, 1938. The House Roads Committee, however, asked that Fed-

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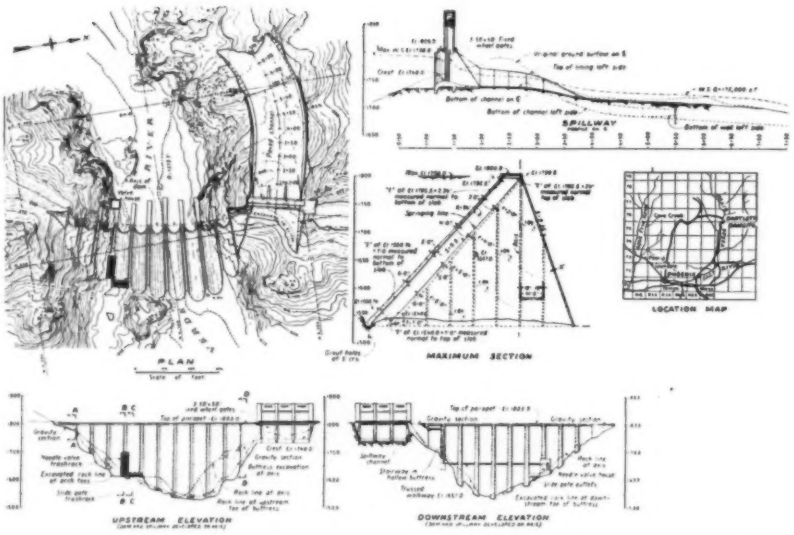
eral aid for 1937 be appropriated as authorized in the Hayden-Cartwright Act. To quote from the report of the Appropriations Committee to the House: "The action of the Committee leaves the provisions of the Hayden-Cartwright Act . . . in full force and effect. The committee is advised by the Bureau of Public Roads that under existing law the Department has authority to apportion the $125,000,000 authorized for 1937 and to approve projects thereunder, which will have the force of contractual obligations upon the Federal Government, as rapidly as the states are ready with such projects."

Without a record vote, the House approved the Agricultural Appropriations Bill, which is now in the Senate. It is believed no opposition will be encountered there.

The Hayden-Cartwright bill also calls for $125,000,000 regular Federal aid in each of the fiscal years ending June 30, 1938 and 1939. In addition $25,000,000 is authorized for secondary or feeder roads in those years.

Bartlett Dam

SEALED BIDS were received by the Bureau of Reclamation for construction of the Bartlett Dam, Salt River project, Arizona, until April 7. This dam will be of the concrete multiple-arch type, and will be located near Phoenix. Among principal items involved, as estimated in advance, are 135,000 yards of open cut common excavation; 185,000 yards of rock excavation in open cut; and 1,000 yards each of backfill and rock fill. Work is to be finished within 800 calendar days from receipt of notice to proceed. Illustrated above are the advance drawings for the dam.

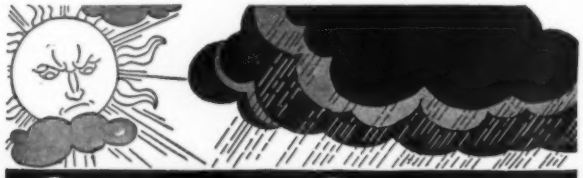


Yakima Ridge Canal

SEALED BIDS will be received until 10 a. m., April 13, 1936 by the Bureau of Reclamation, and then publicly opened, for furnishing labor and materials and performing all work for the construction of earthwork, canal lining, and structures, station 313+00 to station 576+81.5, Yakima Ridge canal, Roza division, Yakima project, Yakima, Washington.

The principal items of work and the estimated quantities involved are as follows:

746,500 cubic yards of all classes of excavation for canal;
9,400 cubic yards of all classes of excavation for structures;



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160,000 cubic yards of overhaul;

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4,500 cubic yards of backfill about structures.

Project to be completed within 350 calendar days from receipt of notice to proceed.

Ask Congress to Abolish Federal Gas Tax

LEGISLATURES of two more states, Alabama and Kentucky, have forwarded resolutions to Congress asking repeal of the 1c per gallon gasoline tax. Memorials of this kind have now been passed by 21 states, while several state legislatures now in session are reported to be considering such resolutions.

Both resolutions point out that the federal tax added to that imposed by their states places a burden upon the users of gasoline beyond that which they should carry, and they also declare that the taxation of sales of gasoline should properly be left to the exclusive use of the states as a means of providing funds for road construction and maintenance.

● *A feature of the Annual Mining Institute held recently at the College of Mines, University of Washington, was this 26-P Bucyrus-Armstrong prospecting drill, owned by the Good News Bay Mining Company of Alaska. The drill was set up for display in front of the College of Mines Building.*

● *Headquarters of the Metropolitan Water District engineering forces at Banning, California.*

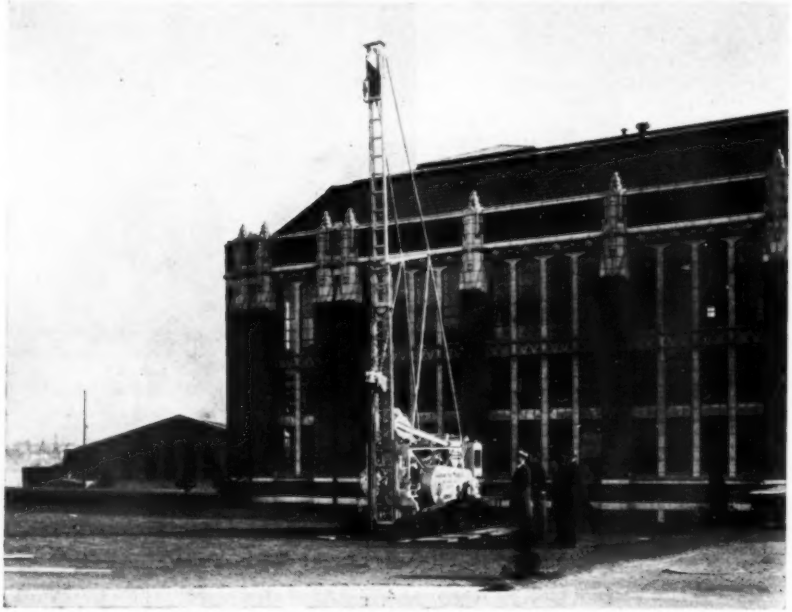
In addition to the opposition of legislative bodies in all parts of the country, additional protests have been raised by the Governors, tax officials and highway officials of many of the other states.

Opposition of the states to the federal tax on gasoline is based on the contention that the federal tax is reducing the revenue which the states themselves obtain from this levy. During the first year of the federal levy state gasoline tax receipts declined $23,000,000.

Revised Bidding Regulations in New Jersey

REVISED regulations relative to prequalification and classification of bidders have been adopted by order of State Highway Commissioner E. Donald Sterner of New Jersey.

Effective April 1, 1936, these regulations require all bidders to qualify under them at least 20 days prior to opening of the bids. As part of this requirement, prospective bidders must submit, under oath, a statement, developing in full their financial standing, adequacy of plant and equipment,



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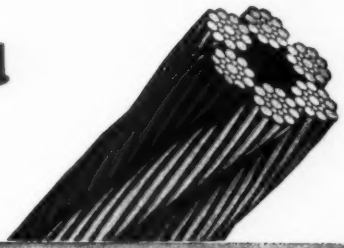

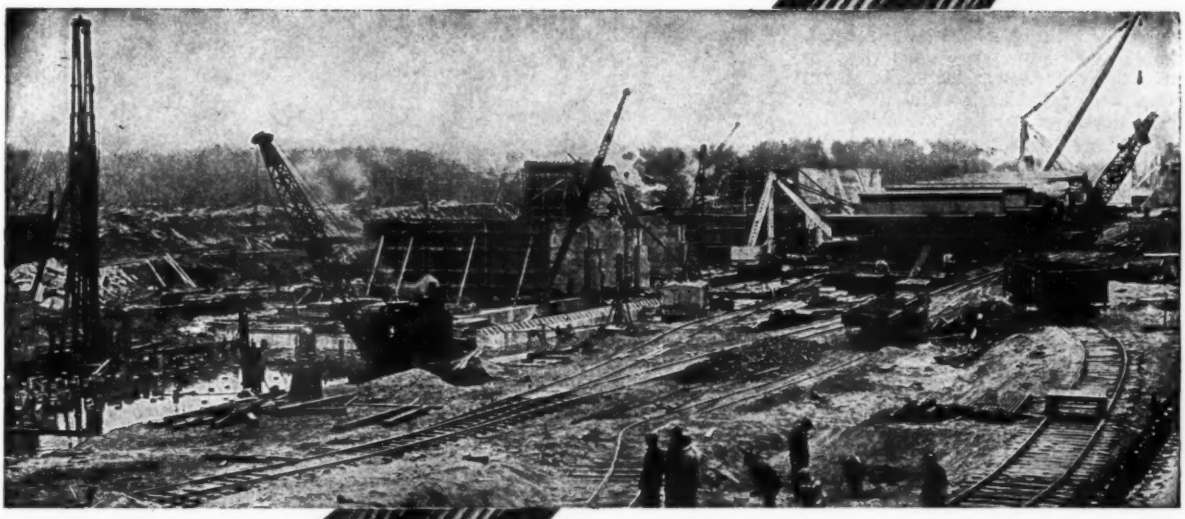

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organization, and prior experience. Bidders are classified as to work on which they are entitled to bid as follows:

A—Type
1. General construction
2. Grading
3. Paving
4. Bridge construction

B—Amount
Twenty-two classes are set up, ranging from $50.00 to unlimited.

Each prospective bidder must state what classification he seeks to establish, both as to type of work and amount. When a classification has been given him, a bidder is entitled to bid on any proposal within his class for a period not exceeding six months from the date shown on his qualification statements.

A complete copy of the revised regulations may be obtained by writing to the State Highway Department, Trenton, New Jersey.

● *Grading for an underpass near Marion, N. C., Neal Hawkins' 10-B loaded 700 yards of dirt into trucks in an eight hour day. Mr. Hawkins is shown standing in front of the shovel. (photo courtesy E. F. Craven Co.)*

Central Valley Appointments

SECRETARY of the Interior Harold L. Ickes recently appointed A. M. Torpen Division Engineer in charge of the Friant Division of the Central Valley Project, thus completing the selection of key men in the Bureau of Reclamation organization for construction of this great California water conservation project.

Torpen formerly was construction engineer of the Pickwick Landing Dam for the Tennessee Valley Authority. He will have charge of the construction of Friant Dam and the Friant-Kern and Madera canals in the southern end of the Central Valley, reporting to Walker R. Young, Construction Engineer of the Bureau who is in general charge of the whole project.

Two other divisional engineers previously had been selected. They are Roy M. Snell, a former Bureau of Reclamation engineer who rejoined the Bureau and who will have charge of the work in the northern end of the Central Valley with headquarters at Redding, and Oscar G. Boden, who was transferred from the Bureau's Owyhee project to become resident engineer in charge of construction of the Contra Costa Conduit with headquarters at Antioch.

Young, who was construction engineer of Boulder Dam, has established general project headquarters at Sacramento.

In addition three consulting appraisers have been appointed to plan and direct the work of appraising properties which must be acquired to provide rights of way. They are B. A. Echeverry, of Berkeley; Frederick C. Herrmann, of San Francisco; and Curtis Walker, of Washington, D. C. A staff of six appraisers, three of whom have been appointed, will be provided.

John C. Page, Acting Commissioner of Reclamation, said preparations were about completed to advertise several major features of the Central Valley project, including relocation of the railroad which runs through the Kennett reservoir above Redding, construction of permanent Government camps near Redding and Friant, construction of Friant Dam and construction of the Contra Costa Conduit.

Several of these jobs will be put on the market as soon as the necessary plans are completed and the rights of way acquired, Page said.

Preliminary studies are under way on other project structures.

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Among the tough jobs of the century is the construction of Bonneville Dam on the Columbia River. Here again ATLAS DIESELS have come through with flying colors. Pictured here are two of the Diesel applications employed by the Guy F. Atkinson Company, in the construction of Bonneville Dam.

The picture above shows an ATLAS DIESEL power unit driving an air compressor which furnished the air for the rock drills. They had to have a dependable air supply—failure means cessation of blasting and a complete and expensive shutdown. The drill runners worked day and night—the ATLAS DIESEL had to operate continuously to keep the drills humming. It did the job well.

At the right is a Bucyrus shovel, powered by an ATLAS DIESEL and working on the toughest shovel job on the entire project. It was chosen for this job because it never broke down and had plenty of reserve power. Note in the picture that it is handling boulders far too large to go through the dipper. They are picked up and placed on trucks by dumping them over the teeth.

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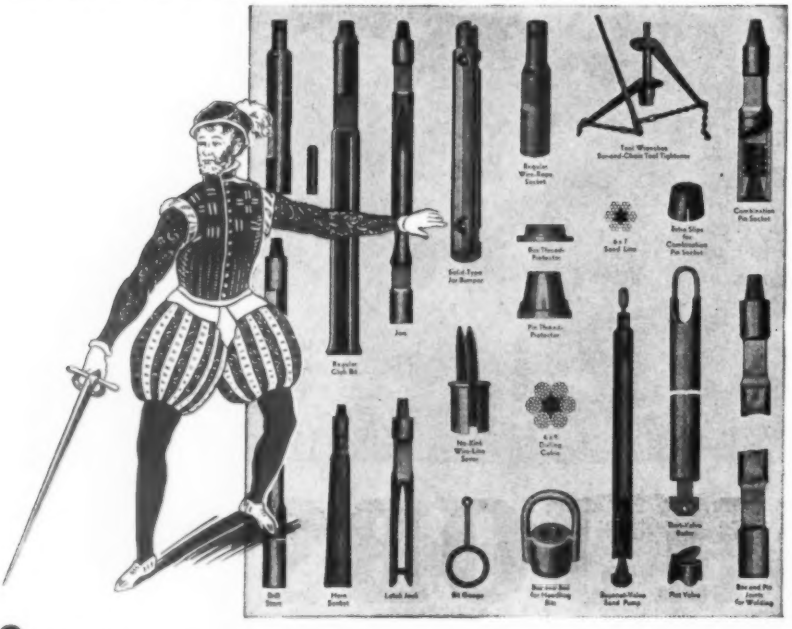

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(*Continued from page 192*)

New, Light Hoist Is Called "Zip-Lift"

AN ENTIRELY NEW line of electric hoists, known as the "Zip-Lifts" with capacity ratings from 250 to 500 pounds, is announced by the Harnischfeger Corporation of Milwaukee.

Designed primarily for "spot handling" work in machine shops, welderies, storage booths, foundries, etc. these units are of all welded construction and are exceptionally light; the quarter-ton model weighing only 100 pounds.

With a ball bearing motor especially designed for hoisting service and smooth operation through a simplified planetary gear train which is fully enclosed and running in oil, the "Zip-Lifts" have hoisting speeds up to 32 feet per minute and are controlled either by push button or pendant rope. To simplify installations, all complicated wiring has been eliminated so that for hook, trolley or jib crane service they need only be hooked up and plugged in like the average electric appliance.

Positive safety is assured with weight-type limit switch, solenoid dry disc motor brake and ratchet and roller type mechanical brake. Standard units are furnished with or without trolley.

New Oilproof Belting Announced

A NEW belting, which has been found after severe laboratory and field tests to be impervious to excessive oil, has been announced by the Dayton Rubber Manufacturing Company. It is called the Dayton Daycoil Oil-Proof V-Belt. The secret of its oil-proof properties is contained in the fact that its base is a synthetic rubber called DuPrene, although DuPrene is only one of several synthetic materials used in its construction.

Before announcing the new belt to the trade, the manufacturers put it to test under conditions much more severe than would ever be encountered. The belts are actually run dripping with oil, under full rated load and with reverse idlers and other attachments to stress the strain and itensify the wear. Within a few hours, under these tests, ordinary belts tested simultaneously would swell, then burst their covering and finally go to pieces.

On the other hand, the new belts showed no signs of swelling ,stretching or wearing after hundreds of hours of this intensified testing. Following the laboratory and dynamometer tests, many field tests were made on machine tool installations where a wide range of oily conditions would be encountered in normal daily plant operations.

For your convenience in writing to Bucyrus-Erie Co., you will find a card bound in this issue.

Built to Beat TIME LIMITS

Timken Bearing Equipped Euclid "Trac-Truk" built by The Euclid Road Machinery Co., Cleveland, Ohio. Body level content capacity, 6 cubic yards. Live load weight capacity, 20,000 lbs.

Modern construction equipment is designed and built on the basis of modern needs—with reserve speed and strength for any emergency.

It includes a liberal use of Timken Bearings because Timkens, with their exclusive combination of Timken tapered construction, Timken positively aligned rolls and Timken Alloy Steel, give the machines every possible advantage and protection it lies within the scope of bearings to provide.

They eliminate friction and so increase speed, prevent wear and save power. They carry radial, thrust and combined loads and thereby increase endurance and lengthen machine life. They hold moving parts in positive and permanent alignment thus assuring constant accuracy of operation.

If you want your new equipment to be in tune with the times — equipment that will enable you to compete successfully when bids are close and time limits severe — it will pay you to see that it is Timken-equipped.

THE TIMKEN ROLLER BEARING COMPANY, CANTON, OHIO

TIMKEN TAPERED ROLLER BEARINGS

For your convenience in writing to The Timken Roller Bearing Company, you will find a card bound in this issue.

Central Valley Project

(Continued from page 188)

doubtedly be almost as great attractions as Boulder, Grand Coulee, Bonneville or Fort Peck.

Kennett Dam will govern water stages in the Sacramento River while in the southern part of the system, Friant Dam will perform similar service on the San Joaquin River. These are, however, only the big controlling dams; dozens of others will be spread out along the foothills of the Sierra Nevadas.

In years of plentiful water in the north and unusual scarcity in the south, water may thus be moved by river and canals more than 500 miles if necessary.

Chief Items in Plan

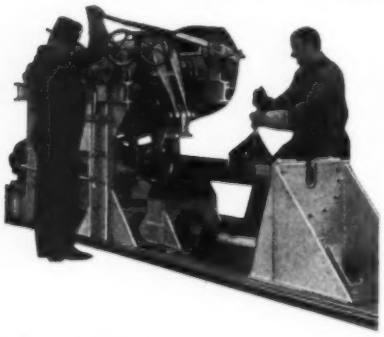
Chief components of the reclamation plan are: Kennett Dam (420 feet high), and Reservoir, estimated total cost $84,000,000; Friant Dam (252 feet high) and Reservoir, $15,500,000; Sacramento—San Joaquin Delta Cross Canal, $4,000,000; Madera Canal, $2,500,000; and San Joaquin River—Kern County Canal, $27,400,000. Excavation involved in the construction of these major units alone will run into millions of yards, for the last named canal is nearly 160 miles long and will require approximately 12,000,000 yards of excavation.

● *Site of Kennett Dam as it now appears. Railroad shown, and a highway, will be moved bodily to new locations as water will completely cover hill in right foreground.*

Benefits from construction and operation of the project are many. Navigability of the Sacramento River will be restored from its mouth to Red Bluff, a distance of 250 miles. Irrigable lands along the Sacramento River will receive an assured water supply, and also additional flood protection. Maintenance of higher levels will mean a reduction of pumping charges for irrigation water. Dependable water supplies will be assured municipalities in the Sacramento Valley. The Sacramento-San Joaquin delta will be freed from the salt water menace and its 400,000 acres of producing lands will have ample water. Manufacturing industries and agricultural areas in Contra Costa County will obtain adequate supplies of fresh water. Navigation on the San Joaquin River can be restored for 86 miles above Stockton by incorporating locks in the dams proposed for the San Joaquin pumping system. Lands now irrigated from the San Joaquin will benefit by reduced pumping charges resulting from higher water levels. Water released in the Sacramento River for irrigation, navigation, and salinity control will be utilized for the development of power to be distributed to agricultural, domestic, industrial, and municipal consumers.

The Central Valley project will rank along the Boulder Canyon and Columbia Basin as one of the most important conservation projects undertaken by the Government.

Sharper Bits = Faster Drilling



Bit Dresser

No. 8
No. 12

A Bucyrus-Armstrong Bit Dresser will sharpen your drill bits in about one-third the time required by hand. In addition, you get 30 to 50% faster drilling with these bits because they are uniformly, accurately, and correctly shaped. If you want to lower your drilling costs, investigate the Bucyrus-Armstrong Bit Dresser. Two Sizes, No. 8 and No. 12. Write today.

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EXCAVATING, DRILLING & MATERIAL-HANDLING EQUIPMENT • • SOUTH MILWAUKEE, WIS.

Yellow Gum from "Blue Earth"

KING TUT'S sarcophagus was varnished with melted amber. That was the hardest resin known then, and it still is. The ancient Phoenicians valued amber highly and braved the storms of the Atlantic in their triremes to gather it from the shores of the Baltic.

The land around the Baltic is still the greatest amber region of the world. On the shores of East Prussia it occurs in colored sand called "blue earth." Amber was one of the first resins used for insulating varnish, but because of its high cost it has been replaced by other materials.

—Westinghouse.

For your convenience in writing to Bucyrus-Erie Co., you will find a card bound in this issue.

Brake and Friction Blocks That Cut Operating Costs

Velvet-smooth, positive control that speeds up operation and cuts down accidents—long life that makes low Brake or Friction Block costs—ease on drums or companion surfaces that decimates maintenance costs—these features of Gatke Genuine Moulded Brake and Friction Blocks help make money and help save it.
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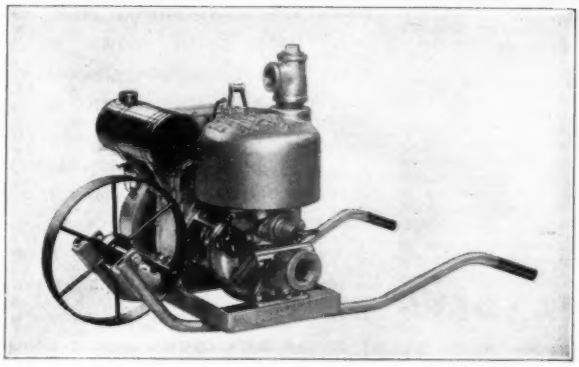

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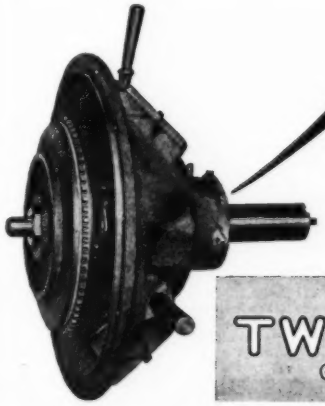
"Best fitted to our application" that's *one* reason the Thew Shovel Co. of Lorain, Ohio, gives for equipping "Lorain" shovels, draglines, clamshells and cranes with the Twin Disc Clutch.

Like so many other makers of road building, material handling and construction machinery, Thew has found that Twin Disc Clutches not only simplify design and operation of their machines but effect important economies in production. And, after using Twin Disc Clutches for ten years, Thew engineers *should be* competent judges of Twin Disc performance.

Write for specific recommendations.* Engineering data on request. *Twin Disc Clutch Company*, 1335 Racine Street, *Racine, Wisconsin.



Twin Disc 7751-G. T.
Gear Tooth
Power Take-Off Unit

TWIN DISC CLUTCHES

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EXCAVATING ENGINEER Bargain Counter

★ ★ ★ THE ITEMS LISTED on these pages have been selected because they offer unusual values to the man who is looking for a bargain. Some of this equipment is surplus stock which has never been used, some is rebuilt and carries new equipment guarantee, some is just plain used. But every item is priced for quick sale. If any of this equipment fits your needs send a postcard or letter, mentioning the reference number, to *Bargain Counter, Excavating Engineer, South Milwaukee, Wisconsin.* We'll pass your inquiry along to the owner and you will receive price and complete information promptly. Act now — with advancing prices on new stock this equipment will move fast.

COMPLETE FRONT END EQUIPMENT

Shovel Equipment

½ CU. YD. DIPPER, 16' boom, 13'8" dipper handle. Shovel equipment suitable for type "A" shovel. NEW. SE-30.

⅝ CU. YD. DIPPER, 12'6" dipper handle, 16' boom. Shovel equipment suitable for type "A" shovel. NEW. SE-31.

¾ CU. YD. DIPPER—23' BOOM—12'6" DIPPER HANDLE—Shovel Equipment suitable for 20-B Gas or Diesel. NEW. SE-15.

¾ CU. YD. DIPPER 25'9" BOOM—14' DIPPER HANDLE—Shovel Equipment suitable for 30-B Diesel. NEW. SE-17.

¾ CU. YD. DIPPER—20'6" BOOM, 17' DIPPER HANDLE, high lift shovel equipment suitable for 20-B steam. NEW. SE-32.

⅞ CU. YD. DIPPER—21'9" BOOM and ENGINE — 15' DIPPER HANDLE — High Lift Shovel Equipment. Suitable for 31-B Steam. NEW. SE-18.

1 1 CU. YD. DIPPER—26' boom, 17' handle Shovel equipment—Will fit 30-B. SE-35.

1¼ CU. YD. DIPPER — 25' BOOM — 17' DIPPER HANDLE — Slightly Used Rope Crowd High Lift Shovel Equipment suitable for Model 37-B. **New Machine Guarantee.** SE-5.

1⅛ CU. YD. DIPPER—27' BOOM—17' DIPPER HANDLE—High Lift Rope Crowd Shovel Equipment suitable only for Bucyrus-Erie 43-B machines. **Rebuilt—New Machine Guarantee.** SE-23.

1 1¾ CU. YD. DIPPER, 30' boom, 19' handle, high lift shovel equipment—Will fit 50-B. New. SE-33.

1 1⅝ CU. YD. DIPPER, 22' boom, 16' handle, shovel equipment—Will fit 43-B. New. SE-34.

Skimmer Scoop

⅝ CU. YD. DIPPER—20' Boom together with all necessary ropes and material to completely convert Bucyrus-Erie 1020 Shovel, Clamshell or Dragline to Skimmer Scoop Machine. NEW. Shipment 2 to 3 weeks. SS-1.

Dragline Equipment

40' CHANNEL BOOM, FAIRLEAD AND ROPES, but not including bucket. For use on Model D-2—20-B—31-B. Used. DL-3.

BRAND NEW Ropes included with each of above Complete Equipments.

Trench Digging Equipment

1 CU. YD. 42½" WIDE—Solid type Dipper—24' Boom and all auxiliary equipment. Will dig maximum depth 22'. For application to GA-2 or GA-3 Shovel. Rebuilt—New Machine Guarantee. DS-5.

BRAND NEW PAGE, two dippers each ¾ cu. yd., one 38" wide over cutters, the other 49½" wide over cutters. 17'1½" Boom and all necessary auxiliary equipment. Will fit Bucyrus-Erie 1030 or 1035. DS-7.

1-CU. YD. 42½" WIDE SOLID TYPE DIPPER—24' Boom and all auxiliary equipment—will dig maximum depth of 22'—For application to GA-2 or GA-3 Clam Shell or Drag Line. **Rebuilt—New Machine Guarantee.** DS-8.

BRAND NEW Ropes included with each of above Trench Digging Equipments.

DIPPER HANDLES

1 7'6" 1030 TUNNEL—Complete. New. H-1.
1 7'10½" 20-B TUNNEL (two sticks). New. H-2.
1 9'0" 31-B TUNNEL (two sticks). New. H-3.
3 9'0" 30-B TUNNEL (two sticks each). New. H-4.
1 9'6" 20-B TUNNEL (two sticks). New. H-5.
1 9'6" 31-B TUNNEL (two sticks). New. H-6.
1 12 0" 18-B—Complete. New. H-7.
1 12'6" D-2, 31-B—Complete. New. H-8.
1 12'6" D-2, 31-B—Complete. New. H-9.
1 13'0" 1020—Complete. New. H-10.
1 15'0" 20-B OIL (two sticks). New. H-12.
3 15'0" E-2 41-B—Complete. New. H-13.
1 15'0" 43-B—Complete. New. H-15.
1 16'0" TYPE "A"—Complete. New. H-16.
2 16'0"—43-B—Complete. New. H-17.
1 17'0"—TYPE "A"—Complete. New. H-18.
1 17'0"—20-B HIGH LIFT—Complete. New. H-19.
1 17'0"—37-B—Complete. Used. H-21.
1 17'0"—50-B OIL (two sticks). New. H-23.
1 19'6"—37-B—Complete. New. H-25.

BOOMS

1—15'0" 1030 CHAIN CROWD SHOVEL BOOM—Used. JA-32
4—18' 20-B STEAM SHOVEL BOOM—New. JA-2.
1—18' 31-B STEAM SHOVEL BOOM—New. JA-3.
1—20'0" 1020 ROPE CROWD SHOVEL BOOM—New. JA-23.
1—20'0" 1020 ROPE CROWD SHOVEL BOOM—New. JA-33.
1—20'0" 1030 CHAIN CROWD SHOVEL BOOM—New. JA-24.
2—20'6" 20-B STEAM SHOVEL BOOM—New. JA-4.
1—21'6" 37-B CHAIN CROWD SHOVEL BOOM—New. JA-26.
1—21'9" 31-B STEAM SHOVEL BOOM—New. JA-5.
2—22'0" 43-B CHAIN CROWD SHOVEL BOOM—Used. JA-27.
3—23' 20-B DIESEL, GAS OR ELECTRIC SHOVEL BOOM—New. JA-7.
1—23'6" 37-B ROPE CROWD SHOVEL BOOM—New. JA-28.
1—24'0" 43-B ROPE CROWD SHOVEL Boom—New. JA-29.
1—24'0" GA-2 DRAG SHOVEL BOOM—New. JA-30.
1—24'0" GA-2 DRAG SHOVEL BOOM—Used. JA-34.
1—24'0" GA-3 DRAG SHOVEL BOOM—New. JA-35.
1—24' GA-2 or GA-3 SHOVEL BOOM—New. JA-8.
2—24' 43-B ROPE CROWD SHOVEL BOOM—New. JA-9.
1—25'0" 37-B ROPE CROWD SHOVEL BOOM—Used. JA-36.
1—25'9" 30-B DIESEL SHOVEL BOOM—New. JA-10.
1—26' 20-B DIESEL SHOVEL BOOM—New. JA-11.
2—26' D-2 SHOVEL BOOM—New. JA-13.
1—26' 50-B STEAM SHOVEL BOOM—New. JA-15.
3—27' 43-B ROPE CROWD SHOVEL BOOM—New. JA-16.
1—27'0" 43-B ROPE CROWD SHOVEL BOOM—New. JA-31.
1—30' 50-B ELECTRIC SHOVEL BOOM—New. JA-17.
3—30' 50-B STEAM SHOVEL BOOM—New. JA-18.
1—40' 20-B, 31-B and D-2 DRAGLINE BOOM—Used. JA-20.

Address all inquiries to Bargain Counter, Excavating Engineer, South Milwaukee, Wisconsin.

DIPPERS

Small Machines

3 ½ CU. YD.—Plate Front—Will fit 1020 Drag Shovel. New. D-45.

2 ⅝ CU. YD.—Plate Front—Will fit 20-B. New. D-12.

1 2/3 CU. YD.—Plate Front—Will fit 14-B. New. D-13.

1 ¾ CU. YD.—Rock Type—Will fit 20-B. New. D-15.

1 ⅞ CU. YD.—Ins. Tooth—Will fit 1030. New. D-47.

1 1 CU. YD.—Ins. Tooth—Will fit Types B, B-2, B-3, GA-2 and GA-3. New. D-48.

1 1 CU. YD.—Plate Front—Will fit 20-B. New. D-42.

1 1 CU. YD.—Manganese—Will fit B-2 and GA-2. Good condition. Used. D-40.

1 1 CU. YD.—Rock Type—Will fit 1030 Tunnel Shovel. New. D-50.

2 1¼ CU. YD.—Ins. Tooth—Will fit 30-B, 41-B, 42-B, E-2. New. D-44.

1 1¼ CU. YD.—Cast Front—Will fit 30-B, 41-B, 42-B, E-2. Used. D-43.

1 1¼ CU. YD.—Rock Type—Will fit 30-B, 41-B, 42-B, E-2. Used. D-27.

1 1¼ CU. YD. — Ins. Tooth — Will fit 37-B. New. D-51.

1 1¼ CU. YD. — Ins. Tooth — Will fit 37-B. Used. D-52.

1 1¼ CU. YD. — Ins. Tooth — Will fit 37-B. Used. D-38.

1 1½ CU. YD.—Ins. Tooth—Will fit 42-B, 43-B. New. D-55.

1 1½ CU. YD.—Ins. Tooth—Will fit 43-B. Used. D-39.

3 1¾ CU. YD.—Ins. Tooth—Will fit 43-B. New. D-58.

1 ⅝ CU. YD. ROCK—Will fit 20-B. New. D-64.

1 1 CU. YD. PLATE FRONT—Will fit 30-B, 41-B, 42-B, E-2. New. D-65.

1 1 CU. YD. CAST FRONT—Will fit 30-B. New. D-66.

Large Machines

1 2 CU. YD.—Manganese—Will fit 43-B. New. D-62.

2 3 CU. YD.—2½" Molybdenum cast steel front, two part Van Port reversible teeth—Will fit 100-B, 68-C, 70-C. New. D-2.

1 3½ CU. YD.—2¾" nickel chrome steel front, two part Van Port reversible teeth—Will fit 88-C, 95-C, Class 80 Atlantic. New. D-3.

1 4 CU. YD.—2¾" Molybdenum cast steel front, two part reversible teeth. In good condition. Will fit 100-C, 120-B. Used. D-4.

1 6 CU. YD.—Molybdenum steel front. Annealed cast steel back, two-part Reversible Van Port Teeth.—Will fit 200-B, 225-B and 320-B. New. D-11.

1 8 CU. YD.—Front Molybdenum steel, two part Van Port Reversible teeth. Slightly used but excellent condition.—Will fit 320-B. Used. D-6.

DIPPER TRIPS

1—30-B STEAM DIPPER TRIP—New. DT-1.

1—31-B STEAM DIPPER TRIP—New. DT-2.

8—50-B STEAM DIPPER TRIPS—New. DT-4.

BUCKETS

Dragline

2 ¾ CU. YD.—BECO TYPE "X". 2200 lbs. New. DB-21.

3 2 CU. YD.—PAGE CLASS "C". 5630 lbs. New. DB-4.

1 2 CU. YD.—BECO TYPE "U". 3650 lbs. Rebuilt. DB-12.

4 2 CU. YD.—BECO TYPE "U". 3650 lbs. New. DB-30.

1 2 CU. YD.—BECO TYPE "X". 5300 lbs. New. DB-23.

2 2 CU. YD.—BECO HEAVY DUTY. 5400 lbs. New. DB-24.

3 2¼ CU. YD.—BECO TYPE "U". 3850 lbs. New. DB-13.

2 2½ CU. YD.—BECO TYPE "U". 4100 lbs. New. DB-14.

1 2½ CU. YD.—BECO HEAVY DUTY. 6500 lbs. Rebuilt. DB-9.

1 2½ CU. YD.—OMAHA—STD. 5400 lbs. Rebuilt. DB-10.

1 5 CU. YD.—BECO HEAVY DUTY. 12700 lbs. New. DB-28.

1 5 CU. YD.—MONIGHAN HEAVY DUTY. 12000 lbs. New. DB-16.

1 6 CU. YD.—MONIGHAN TYPE "W". 12500 lbs. New. DB-17.

1 6 CU. YD.—BECO TYPE "X", 14400 lbs. New. DB-29.

1 7 CU. YD.—MONIGHAN TYPE "W". 1370 lbs. New DB-18.

Clamshell

1 2 CU. YD. TYPE PF WILLIAMS CLAM-SHELL BUCKET without teeth and counter-weight. CSB-1.

ELECTRICAL EQUIPMENT

90 H.P. MOTOR — GENERAL ELECTRIC — 3 phase, 25 cycle, 550 volt, 1500 RPM. NEW. EE-1.

5 KVA TRANSFORMER—GENERAL ELECTRIC—2200-3810 volt primary, 440-220 volt secondary—3 phase, 60 cycle, with cast iron tank and cover, including specially fastened bushings to prevent oil leakage. NEW. EE-4.

125 KW GENERATOR—WESTINGHOUSE—250 volts, 500 amperes, Direct current. 440 RPM. Includes two outboard bearings. NEW. EE-5.

TANKS

Water

5—260 GALLON 41⅞"x21"x6'4". No. 14 BW gauge steel plate. T-1.

2—200 GALLON 36½"x20 1/16"x6'3" high. Elliptical—¼" steel plates. T-2.

1—283 GALLON 54⅜"x17⅝"x6'4". ¼" Steel plates. T-3.

Oil

15—60 GALLON 11½"x18"x77" Elliptical Blue annealed copper alloy smooth plate. T-4.

6—25 GALLON 47¼" dia. 14" deep—12 Gauge Std. Blue annealed copper alloy steel. T-5.

1—294 GALLON 48"x21¼"x6'4". ¼" steel plates. T-6.

4—50 GALLON 60" dia. x 12" deep—No. 12 Gauge Std. blue annealed copper alloy. T-7.

Gasoline

1—44 GALLON 18" dia. 43" high—No. 14 Gauge U. S. Std. welded construction. T-8.

5—55 GALLON 30"x18½"x23½" 16 Gauge—U.S.S. Terne metal. T-9.

Air

3—5 CU. FT.—16" dia. x 48" high—225 lb. working pressure A.S.M.E. Std. Tested to 340 lb. cold water test. T-10.

5—6 CU. FT.—16" dia. x 4'4" high—200 lb. working pressure A.S.M.E. Std. Tested to 350 lb. cold water test. T-11.

1—14 CU. FT.—21½" dia. x 77" high—200 lb. working pressure. Will pass inspection in Massachusetts and any Canadian Province. T-12.

2 16 CU. FT—22⅝" dia. 77" high—200 lb. working pressure A.S.M.E. Std. T-13.

ENGINES

Designed especially for application to Excavating or similar Equipment. Can be used for stationary or semi-stationary service.

Diesel

2—140 H.P. NEW, NON-REVERSIBLE ATLAS DIESEL ENGINES—5 cylinder, 9" bore x 10½" stroke, 514 R.P.M., 4 cycle, vertical overhead valves, dust proof, oil tight crank case and forced lubrication. Includes auxiliary air starting equipment. DE-2.

Steam

1 12½"x16" link reversing type for Railroad Shovel. ME-1.

2 4½"x5" reversible—20.8 H.P. at 400 R.P.M. 100 lb. Pressure. ME-2.

1 4¾"x5" reversible—23.2 H.P. at 400 R.P.M. 100 lb. Pressure. ME-3.

1 5"x5" reversible—25.6 H.P. at 400 R.P.M. 100 lb. Pressure. ME-4.

BOILERS

NEW

Will Make That Old Shovel Work Like New.

Can also be used for Miscellaneous Service

Vertical Type

2 46½"x110"—32 H.P.—155 lb. Working Pressure. Special Wood Burning Fire Box. ASME Std. Will fit any B-2 or B-3. B-9.

Locomotive Type

2 44'x17'—75 H.P. 125 lb. Working Pressure. ASME Std. Will fit Model 68-C. B-13.

1 44"x18'—88 H.P.—125 lb. Working Pressure. ASME Std. Will fit Model 70-C. B-14.

1—70"x12'—136 H.P. 175 lb. Working Pressure. ASME and Mass. Std. Will fit 120-B. B-18.

PUMPS

1 NB—3 STAGE CENTRIFUGAL PUMP—2" suction and discharge — bronze impeller and shaft—capacity 100 gallons per minute at 240' head operating at 1720 RPM or 270' head at 1780 RPM. Now equipped for belt drive but can be operated by 15 HP. Electric Motor. ME-6.

AIR COMPRESSORS

1 BRAND NEW WORTHINGTON—METAL-WELD—2-cylinder 7"x6" Vertical 162 cu. ft. piston displacement, Air Compressor. Fitted with Laidlaw feather valves—Lugs on side for mounting on skids or channels—Shaft extended and equipped with semi-flexible coupling to take 2⅝" drive shaft—Force feed lubrication. Automatic control. Includes 1" High capacity centrifugal circulating pump—"V" belt driven—18"x41" Air Receiver, 100 pounds working pressure, A.S.M.E. Standard. Electric or gasoline power required approximately 30 H.P., approximately 1000 R.P.M.—Compressor Speed approximately 550 R.P.M.—Overall dimensions: Height 45"—length 37½"—width 28". AC-3.

2 11"x11"x12" STEAM DRIVEN LOCOMOTIVE TYPE, Westinghouse air compressors with fittings. NEW. AC-1.

1 11"x11"x12" STEAM DRIVEN LOCOMOTIVE TYPE, Westinghouse air compressors with fittings. Used. Make offer. AC-2.

Digging by "Stame"

(*Continued from page 186*)

acts to apply the shovel is transmitted through this wheel, and the friction is regulated to correspond with the strain which may safely be encountered, it is evident that whenever the shovel is suddenly arrested by a large rock or other impediment, the shock will not be felt back of the point where this wheel is situated and other parts including the upward motion of the machinery of the shovel, may continue to move on as though nothing has happened.

"The shovel is generally filled by the time it has risen ten feet, when the chain tackle ceases to act, and the shovel remains suspended by it from the end of the boom, with its centre of gravity slightly in advance of the point of suspension. The chain connected with its handle now relaxes and the shovel retreats, by its own gravity, two or three feet from the face of excavation, and the crane swings round till the shovel comes directly over the cars standing at the side of the machine. The load is discharged through a movable bottom, turning upon hinges and secured by a catch, the connecting rod of which terminates upon the stand of the conductor.

"The crane now swings back to any position within a half circle where it may be desirable to take up the next load, while, at the same time, the shovel falls to the ground, the movable bottom clasps itself, and all is ready to proceed as before. The alternate swinging motion of the crane is produced by a chain coming from a driving pulley situated near the engine. The middle portion of this chain being occupied by the driving pulley, the two parts lead upward to the roof of the carriage, from which their direction being changed over small pulleys, they pass around to opposite extremities on the rim of a horizontal semi-circular frame, made fast to the boom and projecting from what may be termed the rear side of the mast.

Moving Up

"When all the material within reach of the shovel has been removed, rails are laid down and the machine advances by its own locomotive power to a new station. This motion is accomplished by simply gearing the main shaft of the engine to a cog wheel on one of the axles. The distance moved is usually about three feet, and the time occupied in changing places does not exceed three minutes.

"The average time consumed by each revolution of the shovel is forty-five seconds and the quantity taken up in broken clay varies from one-half to three-fourths of a yard, solid measure. Taking the result of one hour at forty yards, which is making a liberal allowance for contingencies of all kinds, and reckoning eleven hours per day, and twenty-four working days per month, we have 11,500 yards for the average monthly performance of the machine in clay excavation. In sand and fine gravel, upon other public works, it has repeatedly accomplished 18,000 yards in the same time.

Advice to Citizens

"The excavator used upon the Schenectady and Troy railroad is now at work near the 'deep cut' on Section No. 3, one and a half miles west of the city. It will be employed here till June or July next, at which time the whole road will have been completed—this being the heaviest section on the line. Meanwhile we trust that all who have a taste for novelty, or feel interested in the progress of mechanical improvement, will embrace an opportunity of witnessing its performances and satisfy themselves of the benefits, which are to result from its use in the construction of railroads and other improvements.

"But its advantages are not to be enjoyed by public works alone. There is no doubt but it may be applied successfully to the ditching of large tracts of level country such as are everywhere to be met within the southern states. Wherever channels are required of sufficient size to allow of its being applied in the usual manner, (say six feet deep by ten feet in width,) its operation would be attended with most decided economy; and, in drains of lesser dimensions, it might be used with nearly equal success by slightly varying the motion of the shovel so as to allow the carriage to stand upon the surface of the ground.

TROY DAILY WHIG."

The Schenectady and Troy Railroad was some twenty miles in length and was put in operation in September 1842.

Later Excavating Reports

The shovel, in fact two shovels, are next reported as in operation in Brooklyn, N. Y. The Daily Tribune of New York City in an article headed "Steam Paddy" which it published in February, 1842, said:

"In the vicinity of the Navy Yard are two steam excavators

● *Early engineers in this country were not blind to the possibilities of the Otis steam shovel as these testimonial letters from Colonel George W. Whistler and W. H. Swift, written in 1841, indicate.*

Engineer's Office, Western Railroad,
Springfield, October, 9, 1841.

DEAR SIR,—In reply to your two letters of the 1st and 22nd September, I have to state, in relation to the Steam Excavator of Carmichael, Fairbanks, and Otis, that it has been most successfully and advantageously in use for the last three years on this road. I have often witnessed its operating in all kinds of excavation, except rock, and in every case I consider it to work to better advantage than men with picks and shovels could. We have experienced great advantage in the expedition with which excavations are made by this machine. Of course, like all other modes of excavation, it will perform the greatest amount of work in a given time in the easiest kind of excavation, that is, in coarse sand; it has removed often as much as one thousand yards per day in such; but I consider it of most importance and advantage in the kinds of excavation where the ordinary modes experience the greatest difficulties, for instance, in stiff clay and in very coarse gravel, where it is difficult to penetrate with the common shovel.

I consider this machine of great value, and it can be used with great advantage whenever the quantity will justify the first cost. It is a simple machine, easily managed, and not costly.

Respectfully, your obedient servant,
GEORGE W. WHISTLER, Engineer, W. R. R

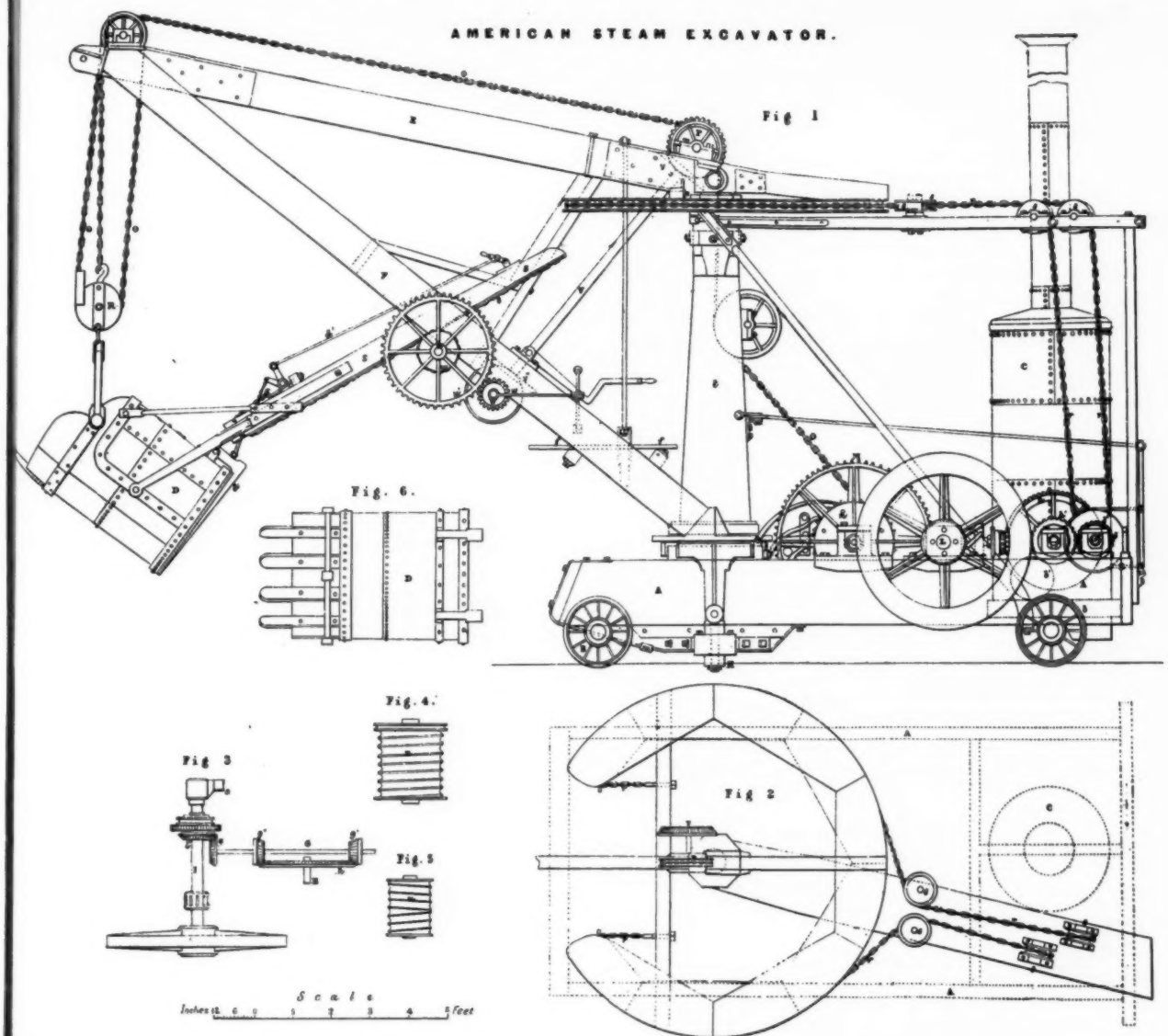
Springfield, September 6th, 1841.

DEAR SIR,—In reply to your letter of the 1st instant, I have to state that the Excavating Machine of Carmichael, Fairbanks, and Otis, has been in use on the Western Railroad upwards of three years. I have witnessed its operations in stiff clay, in compact gravel, mixed with boulders of different sizes, in quick sand, and in common sand and loam. In all these various soils, the machine has worked advantageously, and the most so I consider in the cases which present most difficulty when the ordinary modes of excavation are resorted to—to wit, in the clay and the quick-sand.

I have not at hand the means of stating the amount of material excavated per month in the several soils enumerated, but I recollect that in August 1840, in sand and gravel in the section, it excavated 19,000 cubic yards in twenty-five working-days, and 1000 yards per day were excavated for several days in succession. I consider the machine of great value, susceptible of being applied advantageously wherever earth in any quantity is to be removed, easily kept in repair, and by no means a costly engine.

It is now, as you are aware probably, applied exclusively to work on *terra firma*, but the engine may readily be placed upon a scow, and used with great effect in dredging.

Respectfully,
W. H. SWIFT.



● *Mason's drawing of the Otis shovel, and early English copies, were in perspective. Fortunately, however, an English journal, desiring in 1843, to print an article on the shovel, commissioned a Mr. George Spencer to make a scale drawing. From this drawing it appears that the 1½ yard dipper had dimensions very similar to modern dippers of the same capacity.*

now at work in levelling holes and filling lots. At one operation they each take up a cubic yard of sand which is loaded in a railroad car and sixty cars loaded in an hour, which passes from the hole on tracks laid on an incline plane. The machines cost $4500.00 each. Notwithstanding such facilities, it is said that laborers with their horses and carts can do the work about as cheaply."

Opinions Differ

Shortly thereafter another author wrote:—

"Two of these machines are now employed at Fort Green, Brooklyn, in excavating the hill and filling a deep hollow on the border of the former salt marsh. We have several times paid a visit to this truly wonderful machine, and gazed with astonishment upon its untiring labors. Many steam excavators have been invented, but as far as we can ascertain, this is the first that has been brought into successful operation."

The committee of managers of the fourteenth annual fair of the American Institute of the City of New York were especially commissioned to examine and report upon the steam excavators at work in Brooklyn. Their report reads:

"Accompanied by Professor Griscom, Senators Hunt and Works, General Tallmadge, President of the Institute, and General Chandler, Vice-President, with various other scientific gentlemen, your committee proceeded to Brooklyn and examined the machine in successful operation, cutting down a hill to fill up and form a park in the swamp land near the navy yard. It appears that the original machine was invented some three or four years since by Mr. William S. Otis and has been improved upon since by the present owners, Messrs. Car-

michael, Fairbanks & Otis, and the general agency thereof belonging to Mr. John W. Cochran.

"The excavator would seem to be no new untried conception, but has been employed during the last three years upon the Western Railroad and other places, and that this test has shown an immense saving of expense.

"It works well in clay, sand, gravel and all soils; being placed upon a car it changes its position easily, and advances or recedes in the manner of a locomotive, as the case may require.

"Your committee found the machine at work, and not set up for exhibition.

"The great value and importance of this invention to our country in digging canals, levelling ground for railroads, and the practicability of its application to clearing docks, slips and mouths of rivers, render it of the very first consequence.

"The masses of unruly men collected on our public works will be dispersed by its use, and compelled to till the land, thereby making them good and quiet citizens, and putting an end to the disturbances, quarreling and complaints incident to such collections of men.

"The inventor having died, leaving a widow and family, your committee respectfully recommend the highest premium of the Institute to be given to the widow, with a suitable letter, and a proper diploma to Messrs. Carmichael, Fairbanks & Co. and to Mr. Cochran, to show them the value the American Institute sets upon their services to the country, in perfecting and bringing the machine into practical operation.

"All of which is respectfully submitted.

GEO. C. DE KAY
MARTIN E. THOMPSON
JOSHUA B. HYDE
ALFRED STILLMAN
Committee."

● *Otis and Chapman, and their families, are buried together in the cemetery at Canton, Mass. The spot is marked by this stone shaft. It seems particularly fitting that these men should rest where the first steam shovel was planned and built.*

The work in Brooklyn, the first on record where two shovels were used on one job, was the excavation for the City Park. Considerable progress had been made by January 1842, for Mr. Fairbanks, one of the firm, was asking counsel for a partial payment of $5,000 on account. This request was referred to the finance committee.

Other Projects

In 1840 the Atlantic Basin project was incorporated. It was begun in 1841, encountered difficulties in 1843 and was not completed until 1846.

Carmichael and Stranahan, contractors, did a large part of the work. Carmichael, who owned the two shovels, lived from 1843 to 1846 on Butler Street **near** the Atlantic Basin. It is therefore fair to assume that these two shovels were also used there, probably after completion of the Brooklyn job.

The later use of these two shovels is more or less shrouded in mystery. With Otis dead and Fairbanks probably gone to Russia, only a biography of Daniel Carmichael, the other partner, could clear this up.

It is rumored, but not confirmed, that a shovel or shovels were used in the construction of the Erie Railroad, possibly near Port Jervis, Pennsylvania. In any event, Carmichael and Stranahan are listed as contractors for a portion of the Erie Railroad.

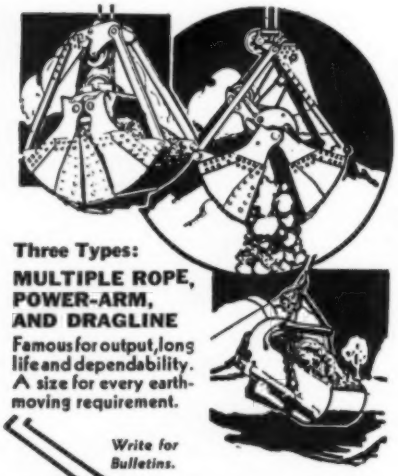
Isaac Otis, a brother of the inventor, wrote as follows in 1872:

"Dillon, Chapman & Clyde used steam excavators on the Lake Shore Railroad near Girard, Pennsylvania, where they had a contract to move 1,000,000 cubic yards of earth."

The work referred to in this letter was done about 1852-1854.

There is every reason to believe that men like Sydney Dillon, O. S. Chapman, C. H. French, T. C. Durant, and others, who at one time were associates or employees of Carmichael, afterward used these shovels on various contracts.

After Otis' death, his cousin, O. S. Chapman, took over the development of the steam shovel. The construction center shifted from Philadelphia to Boston. The demand for steam shovels increased enormously. Don't miss the second installment of this fascinating history in the May Excavating Engineer.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Trade Notes

Bucyrus-Erie Company, South Milwaukee, Wisconsin recently announced the appointment of **Fuchs Machinery and Supply Company**, 1102-4 Farnham Street, Omaha, Nebraska, as Loadmaster distributors for Osceola, O'Brien, Cherokee, Ida, Crawford, Shelby, Cass, Montgomery, Page, and West counties in Iowa; for Nebraska except the counties of Banner, Box Butte, Cheyenne, Dawes, Kimball, Morrill, Scotts Bluff, and Sioux.

Also, the **Jeff Hunt Road Machinery Company**, Corner Lady and Huger Streets, Columbus, S. C., has been appointed Loadmaster distributor for South Carolina.

Vic. Steffeck has been appointed district sales representative for the Minnesota and North Dakota territories of the **Four Wheel Drive Auto Company**. He will work in cooperation with the **Wm. H. Ziegler Company**, Minneapolis, and **H. P. Smith**, Fargo, North Dakota, FWD truck distributors.

The appointment of Harry A. Winne and John C. Miller as managers of sales for two sections of **General Electric's** industrial department has been announced by J. E. N. Hume, manager of the department. Mr. Winne, formerly in charge of the steel mill section of the industrial engineering department, has been made manager of the mining and steel mill section, succeeding K. H. Runkle who was recently made an assistant manager of the industrial department. Mr. Miller, who has been in charge of the department's aeronautical section for some time, has been appointed manager of sales for that section. Both appointments became effective Feb. 6.

Book Reviews

Sand and Gravel Plants—Smith Engineering Works, Milwaukee, Wisconsin, has published a new bulletin covering semi-portable plants for dry screening and washing sand and gravel. Thirteen plants are illustrated by diagrams, and particular uses for which each plant is best fitted are described.

Dynamite—Complete line of explosives and blasting supplies is covered in a new 48-page catalog issued by the **Hercules Powder Company**, Wilmington, Delaware. Characteristics of the company's various types of dynamite are given, and the principal uses for each type mentioned. Blasting caps, igniters, blasting machines, rheostats for testing, and various types of wire are among supplies covered in this catalog.

Pneumatic Tools — A new 16-page bulletin issued by **Ingersoll-Rand**, 11 Broadway, New York City, features the use of the I-R Impact Wrench to save bolting-up time on bridge and building work on railroads. New "Crawl-Air" compressor, regular railroad mounted units, and a variety of pneumatic tools and hoists are also illustrated. Copies of the bulletin may be obtained by writing to the manufacturer.

Gasoline Taxes—An 8-page bulletin entitled "Your Tax Bill," issued by **American Petroleum Industries Committee**, 50 W. 50th Street, New York City, tells what taxes are paid on gasoline and lubricating oils. It discusses the disadvantages of the present system, and such evils as tax evasion, substitution, and price wars which result from the present high taxation.

Colorado River Aqueduct—An illustrated, 57-page book covering need, engineering features, financial status, and progress of the aqueduct has been written by Assistant Chief Engineer Herick, and issued by the **Metropolitan Water District of Southern California.** This book gives a very complete picture of what has been done, is being done, and is planned.

Silicosis as Affecting Workmen and Operations by D. Harrington is a 14-page folder containing the author's address before the fall meeting of the American Institute of Mining & Metallurgy in San Francisco. Mr. Harrington argues that prevention of ill health is as definitely an engineering problem as prevention of accidents.

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SUPERINTENDENT OR FOREMAN

Graduate mining engineer having 25 years' experience, greater part of which has been on coal stripping, is looking for position as superintendent or foreman on some kind of dirt moving job. Has been operating metal mines for past two years. Age 48; married. Prefers to stay in Western States but will go anywhere for right opening. Now located in Arizona. Box 7802.

LARGE MACHINE OPERATOR

Operator with 24 years' experience on all types and makes of machines desires position on large shovel or dragline. Prefers large electric stripper but will consider any permanent connection. Has worked on grading, levee building, quarrying, gravel pit, coal stripping and iron mining. Last job on 750-B coal stripper. Age 45; married. Will go anywhere. Can do own repair work. Best of references furnished. Now located in Indiana. Box 7803.

DRAGLINE OPERATOR

Operator having 20 years' experience—eight years on shovel, ten years on dragline and two on clamshell—desires work on dragline, preferably gas or electric. Experience includes work on levee building, railroad construction, drainage ditches and in quarry. Can do own repair work. Age 42; married. Willing to go anywhere for steady work. Best of references. Located Southern Ohio. Box 8003

DRAGLINE OPERATOR

Dragline operator who has 13 years' experience on levee and ditch work desires position on Bucyrus or Monighan, gas or Diesel power, any size. Operated Diesel machine 7 years; gas-6 years. Willing to go anywhere. Can do own repair work. References furnished. Age 44; married. Now located in Ohio. Box 7903.

EXPERIENCED OPERATOR

Dragline and Shovel operator having 9 years experience desires position operating machine on road building, sewer, canal or drainage excavation. Prefers 3 or 4 yard Diesel dragline, having 5 years experience on Diesel powered machines and 4 years on gas machines. Has operated dragline 5 years, shovel, 2 years, clamshell, 1 year, and crane, 1 year. Age 31; married. Can do own repair work. Best references. Willing to go anywhere. Now located in Illinois. Box 7902.

DIESEL OPERATOR

Sixteen years experience on shovels, draglines and clamshell-cranes—seven years on Diesel powered machines—on drainage work and dam construction are my qualifications. Have also operated steam and gasoline powered excavators. Prefer position on Bucyrus or Monighan steam or Diesel dragline or crane; capacity 1 to 6 cubic yards. Willing to go any place. Can do own repair work. Age 33; married. Can furnish good references. At present located northwestern Ohio. Box 8005.

CRANE-SHOVEL-DRAGLINE OPERATOR

Position operating any model Bucyrus-Erie, Northwest, P&H, or Koehring up to 2 yards capacity is desired by man who has had fifteen years' experience on steam and gasoline machines. Can do all repair work and erecting. Excellent references. Now located in Wisconsin. Will go anywhere in U. S. Box 7801.

DRAGLINE OPERATOR

Operator experienced on levee, revetment and drainage work desires work on Bucyrus-Erie steamer, any size. Seventeen years on dragline, two on clamshell and one on crane. One year each on gasoline and Diesel machines. Can do own repair work. Will go anywhere in U. S. Age 36; married. A-1 references furnished. Located near Memphis. Box 8004.

SHOVEL OPERATOR

Operator—10 years' experience on shovel, dragline and clamshell—on general excavation and mining—desires work on any make and type machine. Can do own repair work. Will go anywhere. Age 40; single. Best of references. Present location near Chicago. Box 8001

DRAGLINE OPERATOR

Experienced crane and dragline operator wishes work preferably on Bucyrus dragline or piledriver. Has operated steam and gasoline machines for 15 years. Willing to go anywhere in U. S. Can do own repair work. Age 39; married. Good references. Located near Chicago. Box 8002

EXPERIENCED OPERATOR

Experienced shovel-dragline-crane-clamshell operator desires work anywhere, preferably in foreign country. Twenty years' experience includes work on gas, electric, Diesel and steam machines. Can do own repair work. Best of references. Present location West Virginia. Box 8006.

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BYERS-BEARCAT — Combination Shovel—Pull Shovel and Lifting Crane; Half swing. Gasoline power. Excellent condition. Located Detroit, Michigan. Box 690-SS.

INSLEY SKIMMER SCOOP—48" BUCKET. Bargain price. located vicinity Moretown, Vt. Box 792-SS.

INSLEY ⅜ YARD GASOLINE COMBINATION SHOVEL AND BACK HOE. Half swing. Steel Cab. Good condition. Located Central Pennsylvania. Box 735-SS.

UNIVERSAL-UNIT ¾-swing combination ⅜ cu. yd. gasoline shovel and 30-foot boom dragline, including ⅜ cu. yd. dragline bucket. Working every day. Good condition. Located Grand Haven, Michigan. Box 769-SS.

UNIVERSAL—MODEL B—GASOLINE SHOVEL. Good operating condition. Located Indiana. Will deliver any point in state. Box 781-SS.

½-YARD

BROWNHOIST MODEL NO. 2 ½ cu. yd. rope crowd gasoline shovel or clamshell. Waukesha four cylinder engine in good operating condition. Bargain price. Located near Peoria, Illinois. Box 689-SS.

UNIVERSAL—MODEL NO. 35—½ cu. yd. shovel and 28' boom clamshell including ½ cu. yd. Owens clamshell bucket. Powered by Waukesha four cylinder 4½" x 6¼" gasoline engine. Engine completely overhauled this year. Entire machine put in first class shape. Excellent condition. Located North Carolina. Box 696-SS.

⅝-YARD

P&H MODEL 300 SHOVEL—18' Boom, 15' Dipper Handle, ⅝ cubic yard Dipper, manganese front. Powered with Waukesha B U 4½"x6¼" engine, power clutch control. First class operating condition. Located Massachusetts. Box 663-SS.

¾-YARD

BUCYRUS-ERIE TYPE B STEAM COMBINATION SHOVEL-CLAMSHELL AND STEAM HOE. Machine completely rebuilt 1929. Good operating condition. Located near Boston. Box 517-SS.

BUCYRUS-ERIE TYPE B HIGH LIFT STEAM SHOVEL. Caterpillar mounted. Good operating condition. Located New Haven, Connecticut. Box 776-SS.

BUCYRUS-ERIE TYPE B CATERPILLAR MOUNTED, HIGH LIFT STEAM SHOVEL. Good operating condition. Located Connecticut. Box 775-SS.

BUCYRUS-ERIE TYPE B STEAM SHOVEL, cat. mounted, equipped with 19'6" boom 16' dipper stick and ¾ yard dipper including 36' clamshell boom in good working order. Located near Hudson, Pennsylvania. Price $1000.00. Box 493-SS.

BUCYRUS-ERIE TYPE B STEAM SHOVEL, Cat mounted, 19'6" boom, 14' dipper handle, ¾ cubic yard dipper. also 36' clamshell boom and front drum and gearing. Located Kansas City, Missouri. Box 622-SS.

1—Type B Bucyrus-Erie Combination High Lift Shovel and 40' Clamshell Machine.
1—Type B Bucyrus-Erie High Lift Shovel.
2—Type B-2 Bucyrus-Erie High Lift Shovels.
All located western Connecticut. Operating condition. Entire lot very low price. Box 573-SS.

BUCYRUS-ERIE 20-B COMBINATION STEAM SHOVEL - CLAMSHELL - DRAGLINE. Good working condition. Caterpillar Mounted. Located near Peoria, Illinois. Box 701-SS.

BUCYRUS-ERIE TYPE B STANDARD ¾ YARD STEAM SHOVEL—Quarry type Dipper—Caterpillar mounted. Good operating condition. Located Georgia. Box 752-SS.

TYPE B BUCYRUS-ERIE HIGH LIFT STEAM SHOVEL. 21'3" Boom, 18'4" Dipper Handle, ¾ cubic yard inserted Tooth Dipper—Power Boom Hoist—Boiler Feed Pump—Caterpillar Mounted. Located Chicago. Box 699-SS.

KOEHRING MODEL 301 COMBINATION SHOVEL & 40' BOOM DRAGLINE, caterpillar mounted Gasoline Power. Good operating condition. Located Indiana. Box 764-SS.

MARION MODEL 21 ELECTRIC—M.G. SET ¾ YARD SHOVEL. Good condition. Located eastern Pennsylvania. Box 725-SS.

NORTHWEST MODEL 3 GASOLINE CABLE CROWD—FEATHER TOUCH CONTROL—SHOVEL. Good operating condition. Located northern Indiana. Box 798-SS.

OSGOOD MODEL 18 Steam—¾ yard shovel—Cat mounted. Just completely overhauled. Excellent condition. Located near Indianapolis, Ind. Box 522-SS.

TWO P&H TYPE 206, ¾ c.y. Gasoline Driven, Crawler Type, 38' Boom with 20' extension, good condition. Fair leads for one machine only. Price $3,000.00 cash each, F. O. B. job site.

One Insley, Type R, No. 128, Full Revolving, ½ c.y. excavator with dipper boom, dipper stick, and dipper; also 30' Boom with 9' extension for crane work. Gasoline Driven, Crawler Type, good condition. Price $2,800.00 cash, F. O. B. job site.

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⅞-YARD

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1-YARD

BAY CITY MODEL "S". 21' Boom, 16' Dipper Handle, 1¼ cubic yard Dipper Climax Blue Streak four cylinder 6"x7" Gasoline Engine. Electric Starter. Excellent condition. Located Boston. Box 757-SS.

BUCYRUS-ERIE LATE MODEL B-2 STEAM HIGH LIFT SHOVEL. 1 yard dipper—single shaft cat mounting. Good condition. Located near St. Louis. Box 518-SS.

BUCYRUS-ERIE GA-2 GAS-AIR COMBINATION ONE YARD SHOVEL AND 45' BOOM CLAMSHELL AND DRAGLINE not including Buckets Recently reconditioned. Located Indianapolis. Box 766-SS.

BUCYRUS-ERIE—GA-2 GAS-AIR SHOVEL. Extra High Lift. Caterpillar mounted. Good operating condition Waukesha 5¾"x8" four cylinder gasoline Engine. Air Starter. Located Chicago. Box 754-SS.

BUCYRUS-ERIE GA-2 Gas-Air High Lift Shovel. 24' Boom, 18'4" Dipper Handle, 1 cubic yard Dipper. Single shaft cat. Waukesha four cylinder gasoline engine. Excellent operating condition. Located Milwaukee. Box 645-SS.

BUCYRUS-ERIE B-2 Steam Combination Shovel and Clamshell Machine. Single shaft cat mounted. ¾ cubic yard Williams Clamshell Bucket included. Excellent mechanical condition. Located Virginia. Box 672-SS.

BUCYRUS-ERIE B-2 HIGH LIFT STEAM SHOVEL. 19'9" Boom, 16' Dipper Handle, ⅞ cubic yard inserted tooth Dipper. Two speed propelling gear. Located Boston. Box 716-SS.

BUYRUS-ERIE B-2 EXTRA HIGH LIFT STEAM SHOVEL. 21'3" Boom, 16' Dipper Handle, ⅞ cubic yard inserted tooth Dipper. Single Shaft Cat. Located Boston. Box 717-SS.

BUCYRUS-ERIE B-2 HIGH LIFT STEAM SHOVEL. Good operating condition. Located Minnesota. Box 794-SS.

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BUCYRUS-ERIE GA-2 COMBINATION SHOVEL AND DRAGLINE. 22'6" Shovel Boom, 16' Dipper Handle, 1 cubic yard cast front inserted tooth Dipper. 50' Dragline Boom including Fair leads but not Bucket. Air Starter. Good condition. Located Newark. Box 718-SS.

BUCYRUS-ERIE GA-2 HIGH LIFT SHOVEL. 24' Boom—18'4" Dipper Handle, 1 cubic yard Inserted Tooth Dipper. Also includes Forward Drum and Gearing and mechanism for clamshell operation including 45' boom. Also 1 cubic yard Williams clamshell bucket. Waukesha WL Engine. Good operating condition. Located Chicago. Box 702-SS.

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B-2 EXTRA HIGH LIFT STEAM SHOVEL. 24' Boom—18'4" Dipper Handle—¾ yard Inserted Tooth Dipper—Boom Hoist—Caterpillar Mounted—Good operating condition. Located Chicago. Box 700-SS.

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MARION 1 YARD STEAM SHOVEL. Box 575-SS.

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NORTHWEST MODEL 105—1 YARD GASOLINE SHOVEL. Thoroughly rebuilt. Machine is in first class operating condition. Located at Crystal Falls, Michigan. Box 804-SS.

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P & H MODEL 600—1 yd. Gasoline Shovel—including 40' boom dragline equipment without bucket. Waukesha Engine. Recently overhauled. Located in Alabama. Box 483-SS.

P&H MODEL 600—1¼ CUBIC YARD GASOLINE SHOVEL. Will be put in good operating condition. Located eastern Pennsylvania. Box 664-SS.

P&H—MODEL 600—Combination 1 yard shovel and 40' boom dragline including dragline bucket. Waukesha gasoline engine. Machine in fair operating condition. Located Georgia. Box 695-SS.

1¼-YARD

BUCYRUS-ERIE GA-2 Gas-Air Extra High Lift Shovel—24' Boom, 18'4" Dipper Handle, 1¼ cu. yd. Dipper, Single Shaft Cat. Electric Starter. Excellent condition. Located eastern Pennsylvania. 592-SS.

BUCYRUS-ERIE GA-2 HIGH LIFT SHOVEL—24' boom, 16' dipper handle, 1¼ cubic yard dipper, on single shaft cat. Electric starter, Waukesha 4-cylinder 6¼"x8" gasoline engine. Reported excellent condition. Located Virginia. Box 623-SS.

BUCYRUS-ERIE — DIESEL-AIR — COMBINATION SHOVEL AND DRAGLINE. 22'6" Boom—16' Dipper Handle—1¼ cubic yard Inserted Tooth Dipper. 45' Boom Complete Dragline Equipment without bucket. Engine—Atlas Diesel. Located Oklahoma. Good operating condition. Box 703-SS.

BUCYRUS-ERIE GAS-AIR TYPE GA-2 HIGH LIFT SHOVEL — 22'6" boom — 16' dipper handle—1¼ yard cast front inserted tooth dipper—single shaft caterpillar mounting—electric starter. Excellent condition. Field reconditioned. Waukesha 4-cylinder 6¼'x8" engine — New cylinder blocks and piston rings. Located near Scranton, Pennsylvania. Will demonstrate. Box 508-SS.

BUCYRUS-ERIE GAS+AIR—22' Boom, 16' Dipper Handle, 1¼ cubic yard Dipper, Waukesha 6¼"x8" four cylinder gasoline engine. Single Shaft Cat mounted. First class condition. Located eastern New York. Box 601-SS.

BUCYRUS-ERIE GA-2 HIGH LIFT SHOVEL. 22'6" boom, 16' dipper handle, 1¼ cu. yd. dipper. Air starter, steel cab, good operating condition, located in North Carolina. Box 805-SS.

LIMA 101 GASOLINE SHOVEL with 1¼ yard bucket. Waukesha motor. In good operating condition. Located in Ohio. Box 808-SS.

LIMA MODEL 101—Combination 1¼ yard shovel and 40' plus 10' extension Dragline—powered with gasoline engine Model JK 6½" x7"—4 cylinder. Shovel equipment practically new. Located Colorado. Box 599-SS.

LINK-BELT MODEL K-42 1¼ YARD GASOLINE SHOVEL. Waukesha Model WL 6¼"x 8" 4-cylinder Engine—new blocks and pistons this year. Good working condition. Located Colorado. Box 738-SS.

LORAIN—75-A—One and one-quarter cubic yard Gasoline Shovel. Good condition. Located Chicago. Box 676-SS.

LORAIN MODEL 75—1¼ YD. SHOVEL. 21'0" boom, 14' dipper handle. Also 45' plus 15', total 60', dragline boom and equipment, and 1¼ cu. yd. Page "M" dragbucket. Engine—Waukesha WL 6-cylinder 6¼"x8" gasoline. Located—Denver, Colorado Box 806-SS.

THEW LORAIN MODEL 75 SHOVEL. 24' Boom, 18' dipper handle, 1¼ cubic yard dipper. Gasoline. Machine now operating. Located central New York State. Box 665-SS.

MARION TYPE 32 STEAMER. Shop No. 5676, 18' boom, 15' dipper handle, 1¼-cu. yd. dipper shipped May, 1926, good operating condition. Box 451-SS.

NORTHWEST MODEL 105 SHOVEL. Bargain Price. Located Texas. Box No. 566-SS.

P&H MODEL 650 1-¼ CUBIC YARD SHOVEL. POWER DIPPER TRIP. Electric Starter. Split Second Control of Power Clutches. Waukesha 4-cylinder 6-¼"x8" Engine. Excellent condition. Located Milwaukee. Box 796-SS.

1½-YARD

BUCYRUS-ERIE—42-B—STEAM SHOVEL—21' Boom, 15' Dipper Handle, 1½ cubic yard Vanderhoef Dipper, Power Boom Hoist, Dipper Trip. Located Connecticut. Box 786-SS.

BUCYRUS-ERIE 43-B GASOLINE CHAIN CROWD SHOVEL — 28' boom — 17' dipper handle—1½ cubic yard Vanderhoef dipper and teeth—electric starter—standard single shaft cat. Operated less than six months. Excellent appearance and condition. Will be demonstrated by owner. Located vicinity New York. No. 512-SS.

If You Do Not Find What You Want Listed—Write Us

Excavating Engineer
South Milwaukee, Wisconsin

LORAIN 75 COMBINATION SHOVEL AND DRAGLINE. 1¼ cubic yard Shovel Equipment. 50' Dragline Boom, without bucket. Waukesha 6¾"x8" four cylinder gasoline engine. Excellent condition. Located eastern Pennsylvania. Box 720-SS.

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P&H MODEL 700—1-½ CUBIC YARD GASOLINE SHOVEL. Waukesha 7-½"x8" 150 Horsepower Engine. Excellent operating condition. Located New Mexico. Box 797-SS.

P & H MODEL 700—1½ CU. YD. GASOLINE SHOVEL. Engine: Waukesha 4-cyl. 7½"x8". Fair working condition. Located New Mexico. Bargain price. Box 789-SS.

1¾-YARD

BUCYRUS-ERIE—50-B—DIESEL SHOVEL. 38' Boom, Two 19' Dipper Handles. 1¾ Cubic Yard Rock Bucket and 1¾ Cubic Yard Dirt Bucket. 60' Boom Dragline Equipment without bucket included. Shovel only located Montana. Dragline equipment located Minnesota. Box 785-SS.

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Under 2 Yards

⅜-YARD

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¾-YARD

BUCYRUS-ERIE 20-B COMBINATION STEAM DRAGLINE - CLAMSHELL - SHOVEL. Good working condition. Caterpillar Mounted. Located near Peoria, Illinois. Box 701-SD.

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1-YARD

BUCYRUS-ERIE GA-2 COMBINATION DRAGLINE AND SHOVEL. 50' Dragline Boom including Fairlead but not Bucket. 22'6" Shovel Boom, 16' Dipper Handle, 1 cubic yard cast front inserted tooth Dipper. Air Starter. Good condition. Located Newark. Box 718-SD.

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LINK-BELT 1 CUBIC YARD CAPACITY 50' BOOM DRAGLINE WITHOUT BUCKET. Gasoline power. Reported good operating condition. Located near Chicago. Box 724-SD.

P&H—MODEL 600—Combination 40' boom dragline and 1 yard shovel including dragline bucket. Waukesha gasoline engine. Machine in fair operating condition. Located Georgia. Box 695-SD.

1¼-YARD

BUCYRUS-ERIE — DIESEL-AIR — COMBINATION DRAGLINE AND SHOVEL. 22'6" Boom—16' Dipper Handle—1¼ cubic yard Inserted Tooth Dipper. 45' Boom—Complete Dragline Equipment without bucket. Engine—Atlas Diesel. Located Oklahoma. Good operating condition. Box 703-SD.

1½-YARD

LINK-BELT MODEL K-44 45' BOOM PLUS TWO 10' AND ONE 5' EXTENSIONS—TOTAL 70' DRAGLINE WITHOUT BUCKET. Gasoline power. Includes 800 Watt Kohler Light Plant. Located near Chicago. Good operating condition. Box 723-SD.

2 LORAIN 75-B COMBINATION DRAGLINES AND SHOVELS. 50' dragline booms without buckets. 1½ cubic yard shovel equipment. Gasoline power. Good working condition. Located eastern Pennsylvania. Box 721-SD.

LORAIN 75 COMBINATION DRAGLINE AND SHOVEL. 50' Dragline Boom without Bucket. 1¼ cubic yard Shovel Equipment. Waukesha 6¾x8" four cylinder gasoline engine. Excellent condition. Located eastern Pennsylvania. Box 720-SD.

TWO P&H 700 DRAGLINES. 1½ cu. yd. buckets on 50' booms. Gas and Diesel. Located Lower Rio Grande Valley, Texas. Box 618-SD.

1¾-YARD

BUCYRUS-ERIE — 43-B GASOLINE — COMBINATION DRAGLINE AND CLAMSHELL— 1¾ cubic yard Bucket capacity—no bucket. Good condition. Located Arizona. Box 704-SD.

SMALL CLAMSHELLS AND CRANES
Under 2 Yards

⅜-YARD

BAY CITY "PUP" CLAMSHELL MACHINE. Good operating condition. Box 514-SCC.

½-YARD

BYERS BEARCAT CLAMSHELL—Crane—30' boom. Will handle ½ cubic yard bucket. Located near Grand Rapids, Mich. Box 648-SCC.

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¾-YARD

BUCYRUS-ERIE 20-B COMBINATION STEAM CLAMSHELL - DRAGLINE - SHOVEL. Good working condition. Caterpillar Mounted. Located near Peoria, Illinois. Box 701-SCC.

O & S MODEL "T" ¾ yard clamshell machine. 40' boom. Good working condition. Powered with Climax 5½"x7" gasoline engine. Located near St. Louis. Good working condition. Box 651-SCC.

1-YARD

BUCYRUS-ERIE GA-2 45' BOOM CLAMSHELL MACHINE. Single Shaft Cat. Waukesha 5¾"x8" four cylinder gasoline engine. Good operating condition. Located St. Paul, Minnesota. Box 761-SCC.

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1¼-YARD

P&H MODEL 700—50' BOOM CLAMSHELL MACHINE INCLUDING 1¼ CUBIC YARD OWEN CLAMSHELL BUCKET. Waukesha 6¼"x8" four cylinder gasoline Engine. Excellent condition. Located Chicago. Box 762-SCC.

NORTHWEST MODEL 105 Gasoline—40' boom clamshell. Good operating condition. Located Iowa. Box 516-SCC.

1½-YARD

OSGOOD "VICTOR" 50' BOOM CLAMSHELL MACHINE AND 1½ CUBIC YARD SHOVEL. Gasoline Power. Good operating condition. Located Wisconsin. Box 760-SCC.

1¾-YARD

BUCYRUS-ERIE — 43B GASOLINE — COMBINATION CLAMSHELL AND DRAGLINE— 1¾ cubic yard Bucket capacity—no bucket. Good condition. Located Arizona. Box 704-SCC.

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LARGE SHOVELS AND DRAGLINES
2 Yards and Over

1½-W MONIGHAN WALKER. Diesel power. 2 yard capacity. 60-foot boom Good condition Reasonably priced. Located Kansas. Box 742-LSD.

2-W MONIGHAN WALKER 3½ yard capacity. 70-foot boom. Good condition. Reasonably priced. Located Kansas. Box 743-LSD.

CLASS 230 STEAM DRAGLINE. 175-foot steel and aluminum boom. 6-yard RED ARCH bucket. Ready to work. Located near New Roads, Louisiana. Box 751-LSD.

TYPE 175-B ELECTRIC, No. 794 equipped with 87' shovel boom, 48' dipper handle, 3½-yd. bucket, and dragline equipment including 125' boom, and 3½-yd. bucket. This machine was recently reconditioned and is in good operating condition. Present, location, Connecticut. Box 263-LSD.

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FOR SALE

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100-C BUCYRUS STEAM SHOVEL on trucks, 3½-yard dipper. New 1914. Willing to sell very cheap. Located near Allentown, Pa. Box 807-LSD.

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70-C BUCYRUS STEAM SHOVEL on Cats. Complete. In operating condition. Shop number 1712. Also one extra three-yard Manganese dipper and sticks. Chicago territory. Box 347-LSD.

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68-C BUCYRUS ELECTRICALLY OPERATED SHOVEL, equipped with 2½-yard manganese front dipper, 3 phase, 60-cycle, 440-volt motors, transformers, cable, reel and approximately 1400 feet of cable all in excellent condition. Reasonable price. Address Box 268-LSD.

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LOCOMOTIVES

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1 Dipper Shaft
1 Crowding Engine
1 Five Yard Dipper

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7—Railroad Type Steam Shovels 2½ to 5 yd.
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50 Shovels and picks, approximate.
1 Fairbanks Morse gasoline engine and 5x5 bulldozer pump 3 HP.
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20 Western dump cars, 5-yard.
2 Galvanized water tanks, wagon size.
Will consider individual sale of separate items.

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April Advertisers

Allis-Chalmers Manufacturing Co. ..... 194 and 195
Athey Truss Wheel Company 173
Atlas Imperial Diesel Engine Company 205
Austin Western Road Machinery Co., The 176
Baldwin Locomotive Works, The 193
Bargain Counter ..... 210 and 211
Bucyrus-Armstrong ..... 206 and 208
Bucyrus-Erie Co. ..... 177, 202, 204, and 4th Cover
Bucyrus-Monighan Company 201
Caterpillar Tractor Company ..... 2d Cover
Chain Belt Company 209
Ensign-Bickford Company, The 169
Firestone Tire & Rubber Company 170
For Sale Advertisements ..... 216 to 219
(See also pages 210 and 211)
Gatke Corporation 209
Hayward Company, The 200
Hercules Powder Company 172
Ingersoll-Rand Company ..... 3rd Cover
Jahn Company, C. R. 200
Koehring Company 175
Koenig Labor Agencies, The 215
Leschen and Sons Rope Company, A. 203
Linn, Mfg. Corp., The 197
National Carbon Co., Inc. 200
Positions Wanted Advertisements 215
Sauerman Bros., Inc. 204
Socony-Vacuum Oil Co., Inc. ..... Opposite 176 and 177
Sullivan Machinery Company 199
Timken Roller Bearing Company, The 207
Twin Disc. Clutch Co. 209
Wellman Eng. Co., The 214
Whitcomb Locomotive Co., The 193

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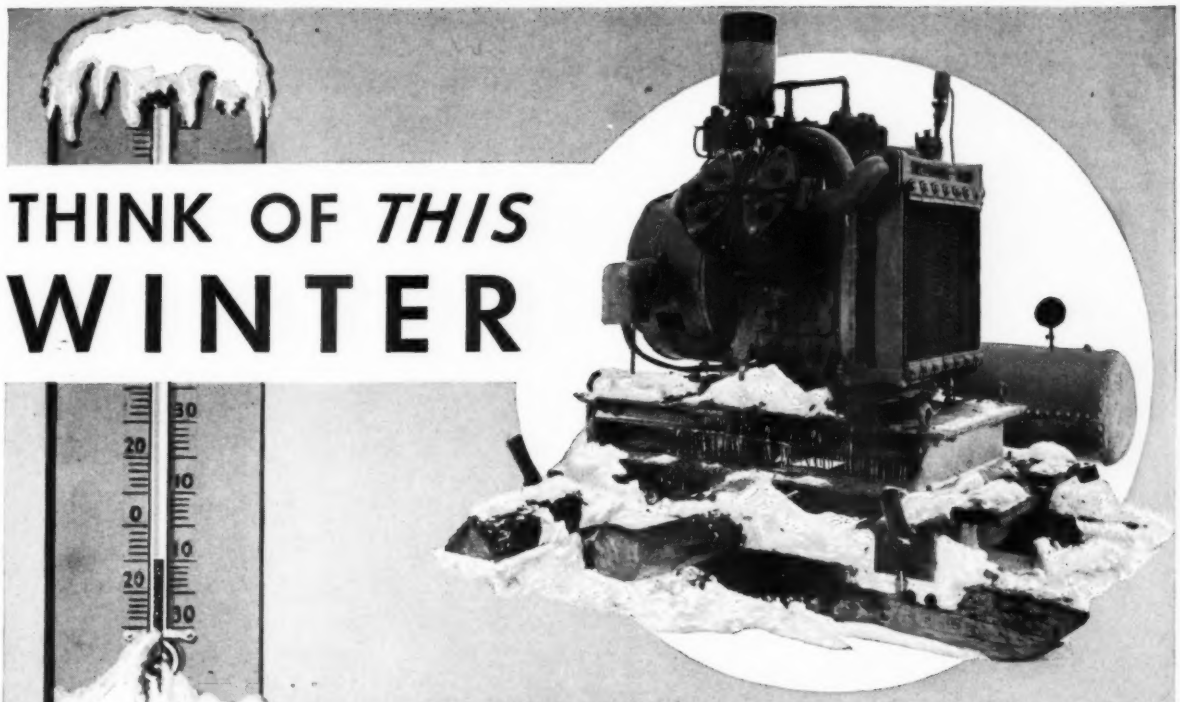

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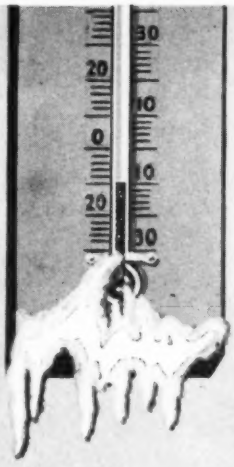

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